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Welding Engineer

DECEMBER, 1955

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and thank them for their confidence in
Jackson Products during the past 21 years.
I hope we may continue to enjoy your
good will for many years to come.

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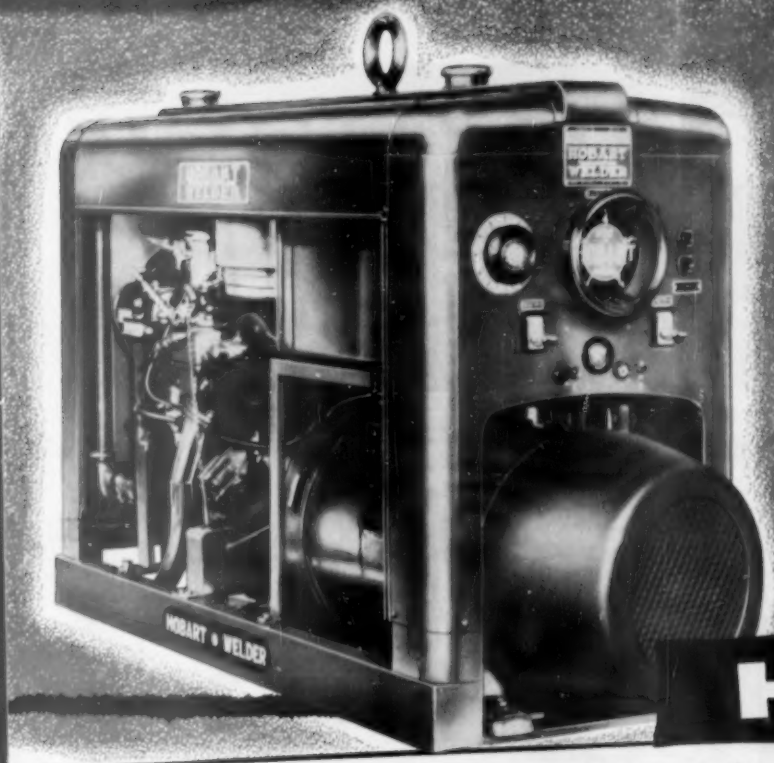

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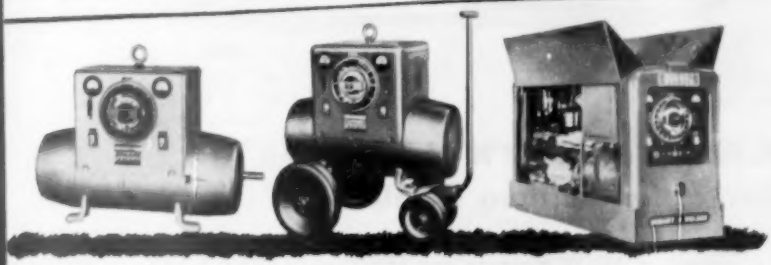

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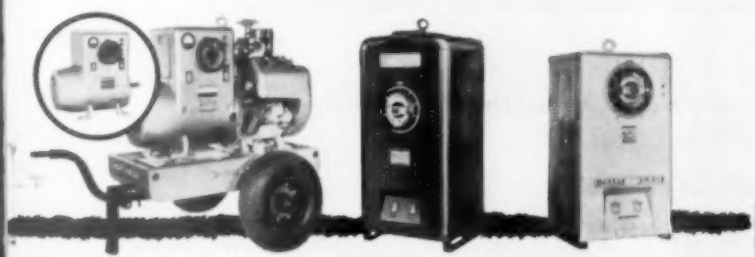

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"Rocket 24" Electrodes for AC or DC This sensational new contact type electrode is heavily coated with iron powder which becomes a part of the weld.

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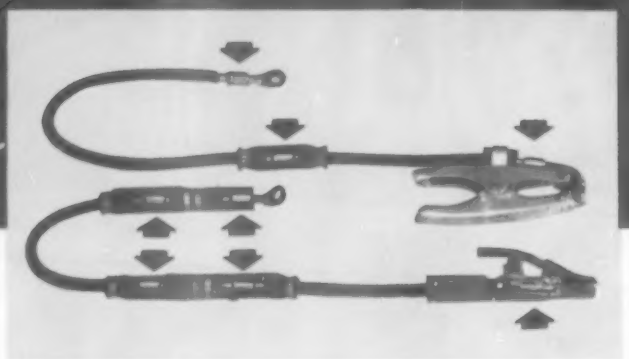

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Welding Engineer

DECEMBER, 1955
VOL. 40—No. 12

A MAGAZINE OF JOINING AND SEVERING OF METALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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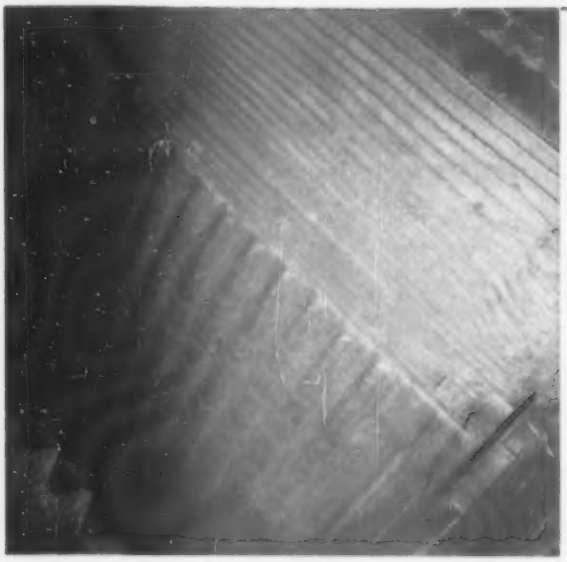

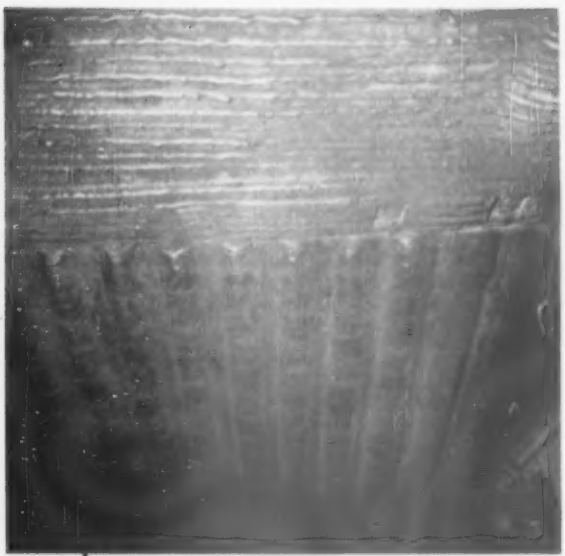

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No Disassembly This jaw crusher was hardfaced with jaws bolted in place, using 3/16″ coated Tube Victorite. Despite cramped working area only 12″ deep and 36″ wide, high deposition rate and low spatter loss enabled welder to get uniform, non-sagging, long-wearing bead without distorting jaw.

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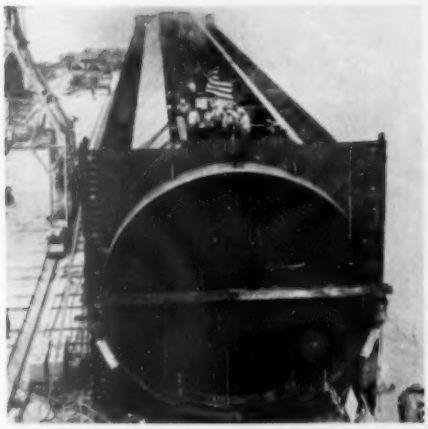


READY for launching, immense 300-ft welded steel tunnel section will be floated to its destination. Section will form part of an automobile tunnel under Hampton Roads, Va. (See story below.)

RESEARCH laboratory will incorporate up-to-date features of design. It will double available development and research facilities and aid in new and broader experimental projects. (See story below.)

News

Welded tunnel casings float to destination

Huge double-shell steel casings, fabricated by Baldwin-Lima-Hamilton Corp., Philadelphia, will be used in building a vehicular tunnel under Hampton Roads, Va. The problem of transporting the 23 sections was solved by floating finished sections down the Delaware River and other waterways to a point five miles from the tunnel site.

Each massive section will be 300 ft long, 37 ft across flats, with inner circular wall, 33 ft in diameter. Baldwin-Lima's weldment department constructed special press dies and welding fixtures to form the steel plate into shape and hold it in position for welding.

Sub-sections of each tube, each 15 ft wide, are weld fabricated in the shop. They are then moved to the launching site on specially built cradles. The sub-sections, still in the cradles, are butted together to form a 300-ft launching tube, and welded into a continuous structure.

Concrete, filling space between inner and outer walls, serves as ballast while the section floats to its destination. Open ends are sealed with steel plate, then the section is launched. The finished tube will form the 6,860-ft underwater part of a 4-mile span from Willoughby spit, near Norfolk. The crossing is scheduled for completion late in 1957.

* * *

Severe price cuts opposed by dealer

Wausau Welding Supply Co., Wausau, Wis., has begun a campaign against severe price cutting in oxygen and acetylene. The firm has questioned widely differing prices for an identical product in advertisements placed in the *Wisconsin Rapids Daily Tribune*.

* * *

Welding, atoms are Midwest Welding topics

Relation of welding to nuclear reactors and rocketry will be considered at the Midwest Welding Conference, Feb. 1 and 2 at Armour Research Foundation of Illinois Institute of Technology, Chicago.

"Welding Problems in Nuclear Reactors" will be the subject of a speech by Robert A. Noland, associate metallurgist, Argonne National Laboratory, Lemont, Ill. Francis H. Stevenson, production engineer, welding department, Aerojet-General Corp., Sacramento, Calif., will discuss "Applications of Welding to Rocketry." (For the complete program, see next month's WELDING ENGINEER.)

Linde expands research laboratory

Expansion of experimental facilities has begun at the Speedway Laboratories of Linde Air Products Co., a division of Union Carbide & Carbon Corp., New York City. The Laboratories are located just outside of Indianapolis, Ind. The program includes conversion of a former factory building into modern laboratory-office building.

The laboratory will occupy a three-story fireproof, air-conditioned building and have floor space of 72,000 sq ft. Projected studies will investigate arc welding, acetylene chemistry and engineering, high-temperature chemistry, and "Flame-Plating" of metals. ("Flame-Plating" is a process recently developed by Linde for coating metals with tungsten carbide. See description in News and New Products sections, WELDING ENGINEER, November, 1955.)

The new structure is planned for completion in 1956.

* * *

Hammon Equipment opens new plant

Hammon Precision Equipment Co. has moved into its new office and plant located in Emeryville, Calif. Officers of the recently incorporated firm are: George L. Hammon, president; C. P. Stuebgen, vice-president; Howard L. Parker, treasurer, and G. H. Dekker, secretary.

With over 32 years experience in the welding and cutting field, the firm is now engaging in custom design and manufacture of cutting and welding apparatus and air-gas products.

SPEAKER at recent CWS Toronto chapter meeting, R. M. Gooderham, director of Canadian Welding Bureau (second from right) shows portable recorder used on trip to Europe. Left to right: George J. Foster, secretary; E. Buscombe, reception committee chairman; Charlie Reid, 2nd vice-chairman; B. Gregg, chairman; Mr. Gooderham; J. Brown, past chairman. (See story below.)

PLASTIC water tank, shown here, was made for use in the Navy minesweeper *USS Cormorant*. The tank, of all-welded construction, has a capacity of 1,028 gal. Use of plastic, instead of metal, has reduced weight one-quarter. Damage repair is expected to be easier. (See story below.)

CWS Toronto chapter learns of European welding

More than 100 members and guests attended the first meeting of the 1955-56 season of the Toronto, Ont., Chapter, Canadian Welding Society. R. M. Gooderham, director of the Canadian Welding Bureau, spoke of his experiences in Europe as a member of Mission No. 250 of OEC (Organization for European Economic Cooperation).

Europe, Mr. Gooderham felt, excels in welded design, while the United States excels in production methods and operating efficiency. Due to lower labor costs and higher prices for steel, Europeans spend more time in design, he stated. Mr. Gooderham also remarked that Europe, in general, has little automatic welding equipment. However, strides are being made to correct this situation, he observed.

Slides illustrating European testing equipment and welding procedures were shown. Mr. Gooderham traveled through 11 different countries as a member of the OEC mission.

* * *

Square D forms English subsidiary

Square D Co., Detroit, has formed an English subsidiary to manufacture and market its electrical distribution and control products. The new firm will handle distribution in the British Isles and Europe. It will be known as Square D Ltd., with headquarters at 100 Aldersgate St., London.

Plans are underway to set up sales branches near Birmingham and Manchester, England, and Glascow, Scotland. These are to form the nucleus of a marketing organization, which will eventually cover selected export markets, as well as important provincial centers in the United Kingdom. James L. Thompson, formerly manager of the Square D regional office in Chicago, has been named general manager.

* * *

Kirkhof Mfg. joins RWMA

Kirkhof Mfg. Corp., Grand Rapids, Mich., recently became a member of the Resistance Welder Manufacturers' Association. Membership now totals 16 manufacturers throughout the country.

* * *

U. S. Industries acquires Southern Pipe & Casing

U. S. Industries, Inc., New York City, recently acquired assets of Southern Pipe & Casing Co., Azusa, Calif. Southern Pipe is a manufacturer of welded steel pipe for transmission of water, oil and gas. The firm will function as a USI division, with no change in management personnel.

* * *

A & R Equipment builds store

A new store building in San Bernardino, Calif., being built by A & R Equipment Co., was scheduled for completion December 1.

Wooden ship has plastic tanks

A wooden ship, containing plastic tanks and plastic pipe, was launched recently for active naval duty as a minesweeper. In an effort to counteract attraction of metal ships for magnetic mines, the 144-ft hull of the *USS Cormorant* was constructed entirely of wood; internal tanks and some tubing made of plastic.

The American Agile Corp., Maple Heights, Ohio, built the *Cormorant's* two fresh water tanks. Each has a capacity of 1,028 gal and weighs 675 lb. The tanks, of all-welded construction, are made of polyethylene Agilene.

The tanks were made self-supporting by extruding polyethylene over aluminum tubing. The tanks, 10 ft long and 48 in. wide at the broadest part of the top, taper to 36 in. at the narrowest part. They are 48 in. deep. *(See "Plastic Welding . . ." WELDING ENGINEER, July, 1955.)*

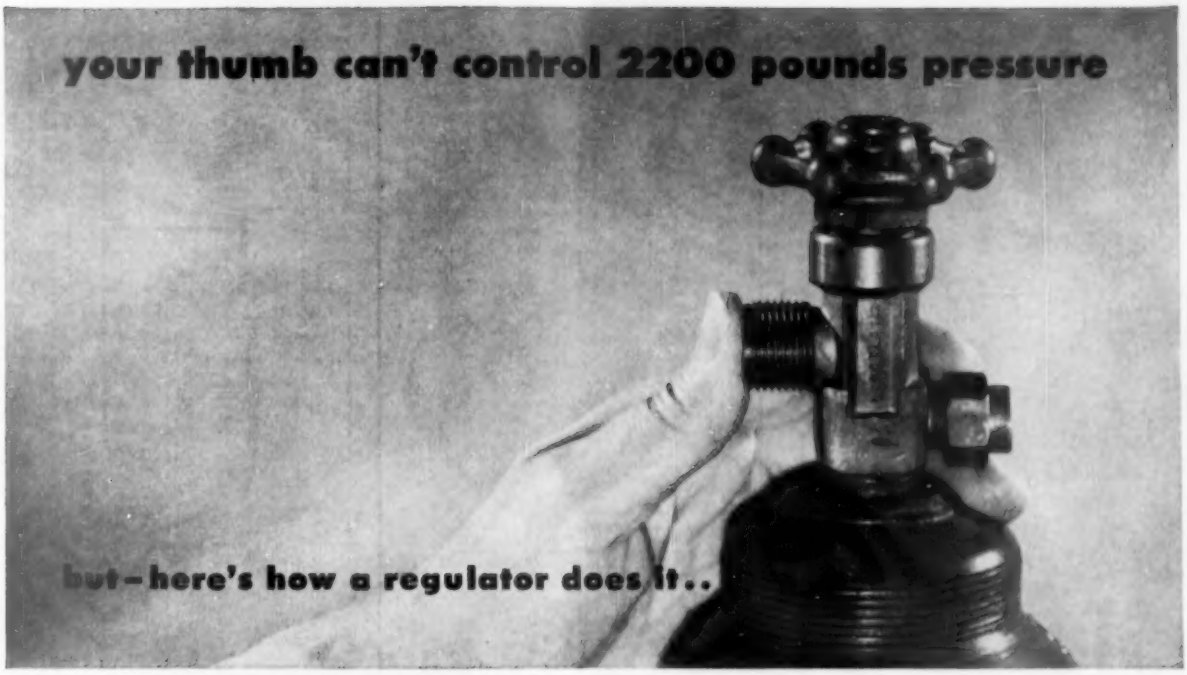
* * *

NWSA zone meetings provide helpful ideas

NWSA zone meetings kept welding distributors in the Midwest and West busy during the first week of November. It was a thought-provoking week.

The Phillips Hotel, Kansas City, Mo., was scene of the West Central Zone meeting, Oct. 31 and Nov. 1. Vice-president C. S. Rutherford, R & R Welding Supply Co., Des Moines, Ia., was chairman of the three sessions

(Continued on page 85)



here are some of the interesting questions this book answers about regulators

How do regulators work — what is the difference between a single and a two stage reduction regulator — how does a gauge differ from a flowmeter — why are some regulators hard to adjust — what is a line regulator — what modern safety protection should a good regulator possess — what does the regulator inlet filter do — are big springs and large diameter diaphragms an advantage — how should one order a regulator

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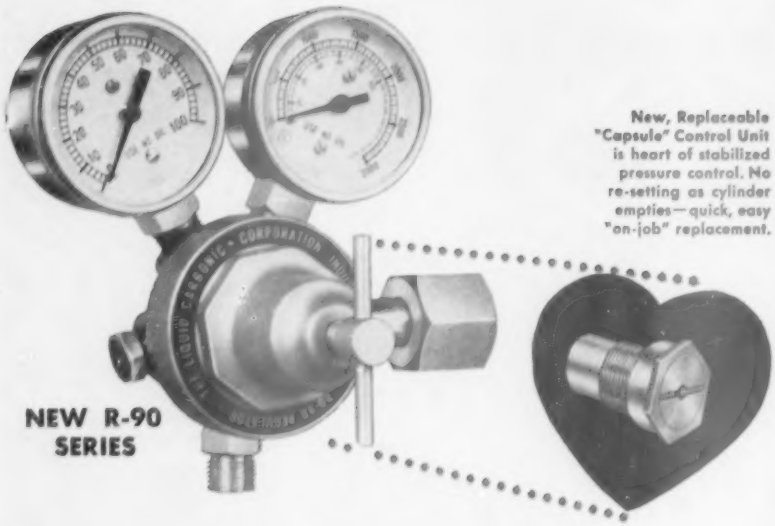
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Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Flame-straightening

Dear Sir:

We have read with interest the article, "Flame-straightening: a friend in need," by Joseph Holt, which appeared on page 44 in the October issue of WELDING ENGINEER. We would appreciate your advising us where we can obtain a book on this subject.

John B. Bredengerd
Salina Mfg. Co.

—Mr. Bredengerd has been referred to Mr. Holt. Other readers interested in the contraction method may write to Joseph Holt, Route 2, Box 138, Snohomish, Wash.

* * *

More on welded house!

Dear Sir:

In your June issue I noticed an article on a welded home. Would it be possible to get blueprints and specifications on various types of buildings, both residential and commercial? We are particularly interested in framing of welded steel-construction, with the outside walls of brick or masonry.

H. W. Perkins
Superweld of Goldsboro

* * *

Dear Sir:

I would like to secure the address of John D. Bert, author of the article on low-cost welded homes.

I have had many arguments about steel houses of the future and feel your magazine will help me in proving my points.

If it is possible, I would like to get the blueprints and estimated cost of building a home of this type.

In addition, I would like to compliment you upon the August issue of WELDING ENGINEER. I believe that your magazine is the best for any weldor who wants to stay abreast of modern developments. I am pleased that I can get full and competent in-

(Continued on page 48)

THE TOUGHEST, MOST FLEXIBLE WELDING CABLE you've ever used!

Ask any welder who uses Carol Dynapower Welding Cable. He'll tell you it's so pliable that he can bend it, coil it, and twist it wherever he wants . . . with so little effort that he makes top quality welds with minimum fatigue. The reason: Carol's special rope lay stranding that combines thousands of soft, fine wires into a flexible cable. It's plenty tough, too. Its abrasion-proof jacket of Carol rubber stands the roughest handling, and resists acids, solvents, water and oil. Available in sizes from 4/0 to No. 6 gage in rubber and Neoprene jackets.

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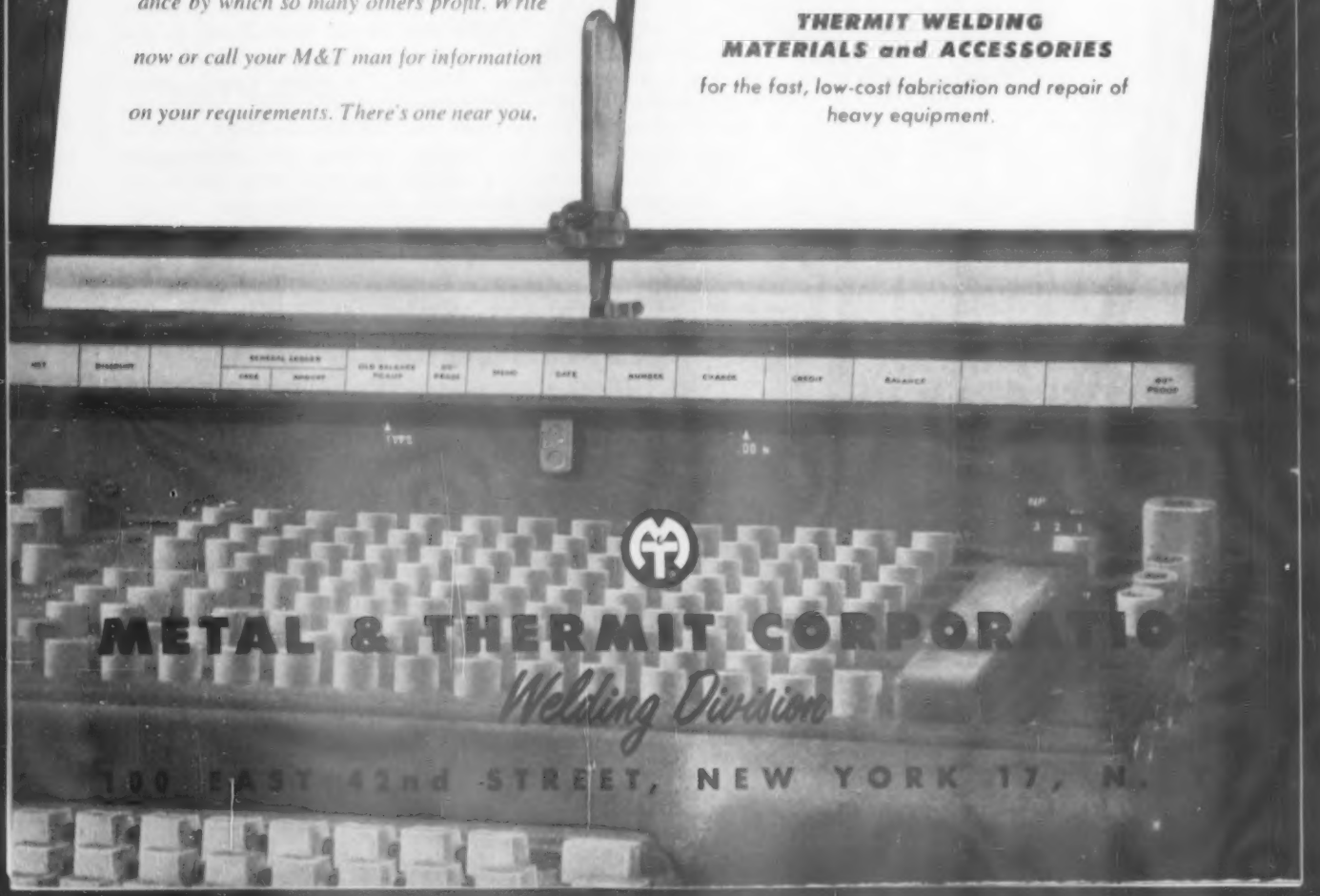

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The Alkalume Process assures you a reliable—day after day—production of a uniformly weldable surface—regardless of alloy. Processed stock welds fast and easily producing welds that meet specified values for penetration and shear strength. In addition, with Alkalume Processed Stock, welds are made at lower pressure. The Alkalume Process reduces the number of tip dressings, thus giving you greater tip life.

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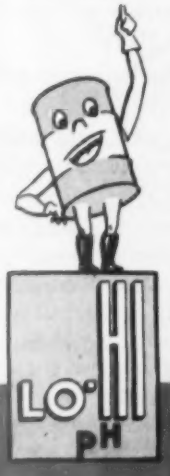

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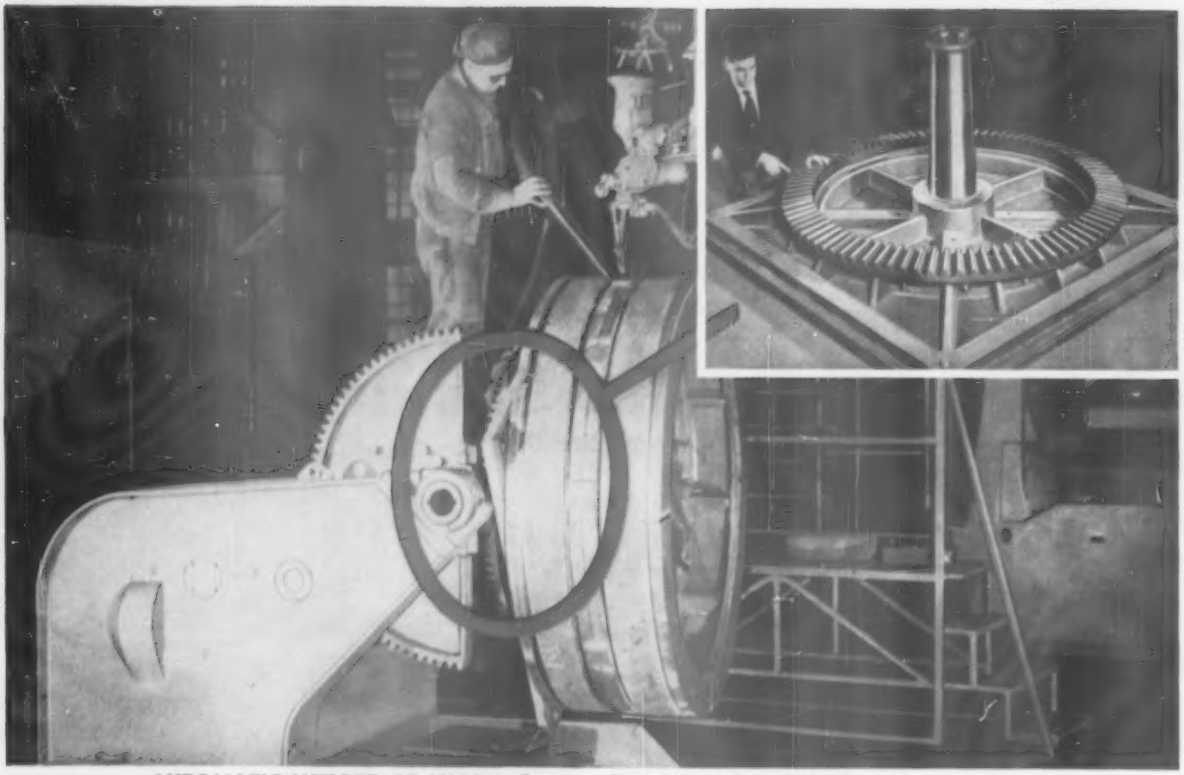

AUTOMATIC WELDER AT WORK. Inset shows extra-large spindle and rugged bull gear of Worthington Welding Positioner, rated at 24,000 pounds, continuous duty. Worthington's positioner ratings are not just a by-product of the design. Rather, they are the result of extensive tests in laboratory and field.

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FREE New Bulletin R-1700-B15 shows you how to choose a positioner. It answers the seven basic questions you should ask before you buy *any* positioning equipment.

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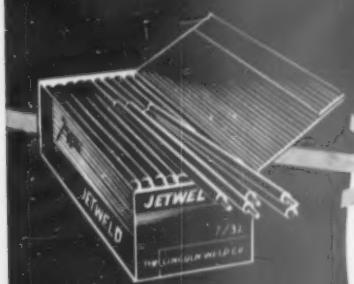

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Seek and ye shall find

THE BIBLICAL text, "Seek and ye shall find," has proved a discouraging slogan for many of those interested in welding. The educational need for welding has been a somewhat neglected phase of the welding industry.

When more people—particularly engineers and designers—become acquainted with the advantages of welding, more welding will be used. The biggest job of all those who earn their livelihood from welding is *educating the public.*

Unfortunately, much of our educational work to date has been of a negative nature. The public has learned of the failure (attributed to welding) of some 15 welded ships. These reports gave welding a bad name, although more than 4,000 welded ships have been virtually crack-free.

The public, likewise, has been fully informed of the many buildings the "acetylene torch" has burned down. Rarely are they told of the careless supervisors and flame-cutters who carry on their operations under unsafe conditions!

Our engineering students receive thorough training in methods of joining metals, but the methods discussed are almost always the same ones that we learned when we went through engineering school twenty-five years ago. Or, for that matter, the same ones my father studied at the turn of the century.

Something is wrong some place and the responsibility for correction lies with those of us who are promoting modern joining and severing methods.

Welding is not the "cure-all" for our joining needs. In the pages of this magazine, other joining methods have been discussed and even recommended when they best served a specific purpose. We will continue to follow this policy.

OUR desire is to see materials joined in the most efficient and economical method for service conditions. It is only by such a practice that the public will obtain the best in value, design and operation at the lowest cost.

We are firmly convinced that unnecessarily restrictive codes and regulations, as well as restrictive labor practices, are making welding more costly than necessary.

Poor design, poor material selection, poor selection of welding methods, poor procedures and sequences, and poor supervision all add up to poor welded products.

Many of these "poor" combinations could be overcome by educating the user. Given adequate training procedures, they could be eliminated. On page 30 in this issue there appears the concluding part of a series by Joe Holt, who has pioneered the use of the oxyacetylene flame for correcting errors in judgment on the part of weldors and other fabricators.

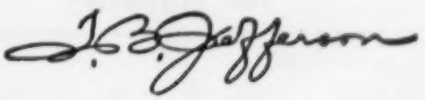
BY THE simple expedient of putting expansion and contraction to work for him, Joe Holt has reclaimed damaged bridges and saved highway departments throughout the West hundreds of thousands of dollars. Universal adoption of his simple methods could save additional sums expended in time and effort on structural welding, ship building and other applications where poor design and incorrect welding sequence has resulted in distorted and misshapen products.

If we cannot immediately educate the user to do a job correctly in the first place, maybe we should teach him the proper way to correct his errors. In a majority of cases, distortion may be avoided by a proper welding sequence. But in those cases where it does occur, the proper application of the oxyacetylene flame can easily and economically set things right.

The knowledge needed for the efficient and effective joining of materials by welding methods is available. Let us get properly coordinated to pass it on to those who need it. Unfortunately, not all of those who need education in welding will seek it.

However, if all of us in welding will do our part in educating students, teachers, engineers, designers, prospective users and users, the answers to their problems and needs will easily be found.

If we make welding information available to those who seek such knowledge, the growth of welding will be phenomenal.



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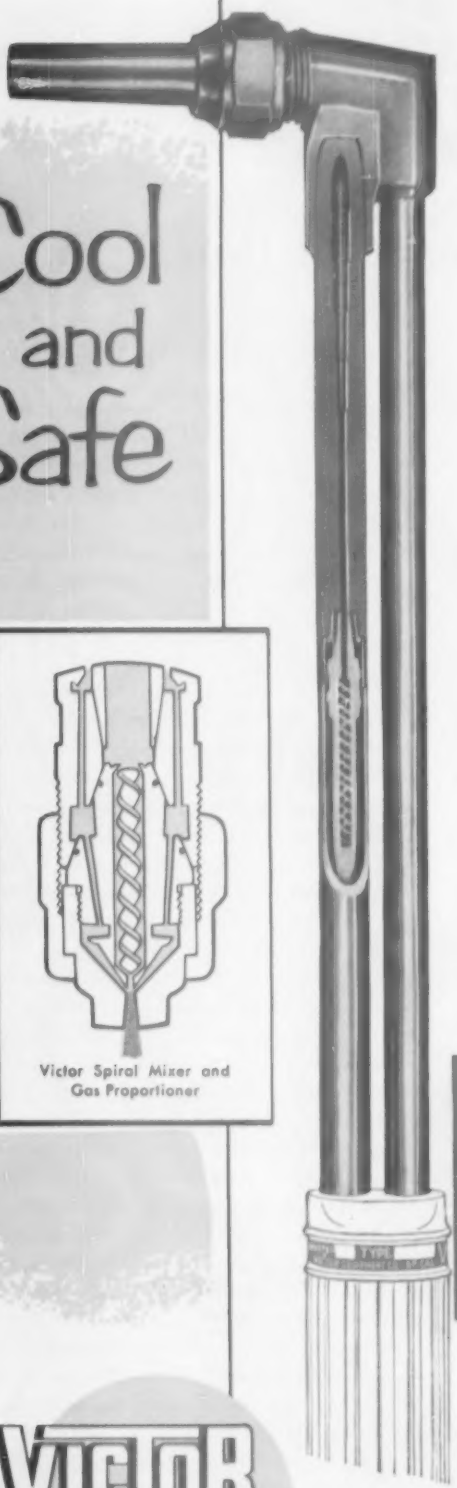

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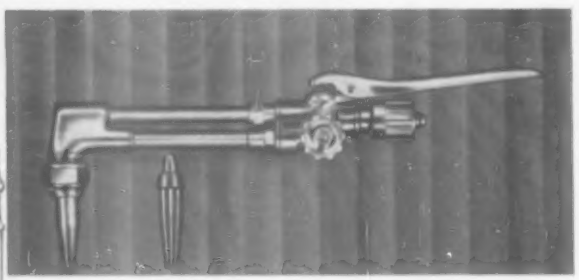

Cutting attachment, and cut-away of a typical Victor tip, showing carefully proportioned orifices. For best results, always use Victor tips with Victor torches.

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"FROM the standpoint of efficient operation and service life, copper appears to be the preferred material for welding cable," says the author. →

In its September issue, **WELDING ENGINEER** *presented an article by a manufacturer of aluminum welding cable. Naturally, the author stressed the advantages of this cable type over copper cable. Taking no sides in this important industry problem, the editors invited a representative of copper cable manufacturers to present his views. The offer was accepted and the facts concerning copper cable are given below.*

Copper vs. aluminum cable

The case for copper . . . . . BY H. C. RAPP, *Belden Mfg. Co., Chicago*

BECAUSE of the weight factor, aluminum welding cable appears to offer a tempting labor saving compared to conventional copper cable. Here is a weight comparison of a few aluminum and copper cable sizes:

Cable size	Weight per M ft
1/0 aluminum	211 lb
1/0 copper	457 lb
1 copper	362 lb
2 copper	297 lb

In the 1/0 size, aluminum cable has an almost overwhelming advantage over copper as far as handling ease is concerned. However, 1/0 aluminum, electrically, is only as good as No. 2 copper on a heavy-duty basis. Thus, the weight is 211 lb vs. 297 lb.

Very few people have occasion to pick up 1,000 ft of cable at once. Instead, the average weldor is concerned only with the direct weight of 10 to 15 ft of cable. The balance of the cable lies on the floor.

The comparison, then, is really between 21 lb and 29 lb. Percentagewise, this is quite a difference, but in actual pounds it is not very significant.

Heating and Cooling

It has been stated that for light-duty welding, equal sizes of aluminum can be substituted for copper because aluminum cools faster than copper.

Actual heating and cooling tests show that on equal loads, aluminum heats up more quickly than copper and, having attained a high temperature, does not cool off appreciably faster than copper.

However, when aluminum carries an electrical load based on its actual conductivity, its heating is not excessive.

One of the biggest problems associated with the use of aluminum is that of making proper or adequate electrical connections. Aluminum oxide, always present on the surface of aluminum, is an excellent electrical insulator.

If this film is not destroyed by mechanical or chemical means, a great deal of heat build-up occurs during the passage of heavy welding currents.

The figures in the heating chart demonstrate the need for efficient aluminum cable connectors, especially in case of overloads. The usual mechanical connectors used on copper cable are not effective on aluminum. Solder is the only satisfactory method.

Some Disadvantages

Excessive heat build-up in a welding cable is bad for two reasons:

(1) Heat at the electrode holder adds to the weldor's discomfort and limits the time he can devote to actual welding.

(2) Heat anneals aluminum to its dead-soft stage.

Mechanical properties of aluminum are tricky when combined with electrical requirements. Dead-soft aluminum has the most desirable limpness and electrical conductivity. But at this stage it is also very weak and strands break easily.

It is so soft that in mechanical connections it flows away from pressure, which causes connectors to loosen more rapidly.

Semi-annealed aluminum, generally, is thought to have the best balance of mechanical and electrical properties. However, it cannot be fabricated into strands smaller than No. 30, whereas copper welding cable is usually fabricated from No. 34 strands.

Cable Flexibility

Pliability and flex-life of a cable are quite directly related to the size of individual strands: the smaller the size, the greater the flex-life.

One of the main requirements for welding cable, other than current-carrying capacity, it is ability to stand up under repeated bending and twisting at the electrode holder without excessive strand breakage.

Cable size	Cycles to Failure
1/0 aluminum	5,750
1/0 copper	31,185
1 copper	18,949
2 copper	17,780

Comparative tests were made on a flexing tester which simulates the action at the electrode holder, bending the cable back and forth through an arc of 180 deg. Failure was counted as the number of bends at which the conductor would not carry a load of 7 amp at 110 volts.

The actual number of cycles might be different under actual welding conditions and currents, but results would follow this same relative order.

One of the chief maintenance jobs on welding cable is the constant disconnection of electrode holders to cut out broken strands. With aluminum cable, this work would have to be done at least three times as often as for copper.

Makes Both Types

As welding cable manufacturers fabricating both cable types, Belden obviously appreciates the advantages of both copper and aluminum. For many years, aluminum wires have been cabled and insulated for other uses.

The chief aim has been to provide welding cable which will stand up in service for a maximum of time at minimum cost.

The charts should indicate that users of aluminum cable must accept a shortened service life with very little working advantage in weight saving.

Furthermore, in order to avoid serious overheating problems, all connectors must be soldered and the conductivity of aluminum should be estimated at 61% that of copper.

From the standpoint of efficient operation and service life, copper appears to be the preferred material for welding cable.

Temperature rise from room temperature

(Measured on exterior of connector; 10-minute load application)

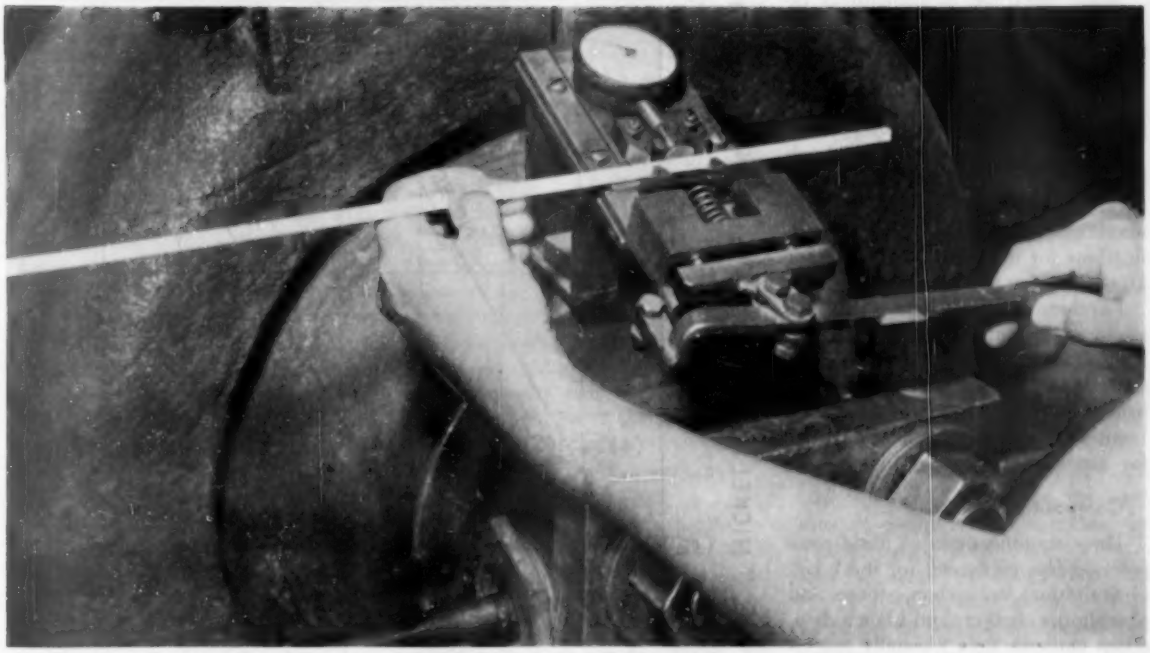
Type of Connector	1/0 Copper 300 amp	1/0 Aluminum 300 amp	1/0 Aluminum 200 amp
1—High-pressure clamp connector, no treatment of conductor:	25 F	57 F	31 F
2—Like No. 1 but aluminum cleaned and oiled:		51	27
3—Special crimped connector with zinc chromate paste:		43	28
4—Penetrating screw type:	29	51	42
5—Soldered connection: Tin-lead solder:	20		
Aluminum solder:		22	15
6—Welding electrode holder, Allen screw connection, no conductor treatment:	53	77	40

HEATING

Temperature measured by thermocouple inserted into center of strands

Minutes	1/0 Copper 300-amp load	1/0 Aluminum 300-amp load	1/0 Aluminum 200-amp load
0	100 F	100 F	100 F
2	102	112	106
4	109	125	114
6	113	135	119
8	122	142	124
10	125	149	127

300 amp: NEMA standard for 1/0 copper;
200 amp: NEMA standard for No. 2 copper or 1/0 aluminum, based on aluminum having conductivity equal to 61% of copper.



STAINLESS steel electrode is given concentricity control test. Near-perfect concentricity is necessary for proper working characteristics.

Precise testing methods insure . . .

Quality control of stainless electrodes

Successful operation in any industry frequently depends on control of little, often seemingly insignificant details. A few pounds of weld metal, for example, may be the critical factor in determining service life of a massive industrial process unit.

Success or failure of an entire industrial process, not to mention the possible loss of lives and property, repeatedly depends on accurate control of such weld deposits.

Here are some of the quality control practices instituted by one large producer to make the modern stainless steel electrode a precision production tool.

By H. F. REID, JR.*

ELECTRONIC and wet chemical analyses of stainless steel core wire are made in electrode producer's laboratories.

RAW materials used in producing stainless steel welding electrodes fall into two distinct categories. Problems relating to composition and identification of the twenty or more grades of stainless core wire used in producing a full line of products are distinctly different from those related to control of the hundred or more grades and types of dry powdered materials employed.

*Technical Service Division, The McKay Co., Pittsburgh, Pa.

Many electrode manufacturers redraw stainless wire from hot-rolled rod. None of the electrode manufacturers, however, are steel producers.

They are dependent on commercial steel producers for the composition and quality of starting material, either hot-rolled rod or bright drawn wire. As steel purchasers, electrode manufacturers must establish specifications for materials best suited for arc-welding usage.

Purchase specifications of various electrode manufacturers are varied. In general, however, such specifications follow composition limits established by American Iron and Steel Institute, with specific modifications for arc-welding applications.

Composition Control

These modifications of basic composition frequently call for more rigid limitations on carbon, silicon and phosphorus contents and higher chromium contents than normally associated with plate and sheet material of the same grade.

Specifications of higher chromium content in wires for arc-welding usage is one of two methods used to offset losses in chromium content due to oxidation in passage across the arc. Fortification of the coating with additional chromium alloys is the second method.

Combination of these two techniques permits close control of chemical composition and resultant structure of weld deposit. Seemingly minor variations in composition levels may alter markedly the resistance to cracking and corrosion of an essentially austenitic weldment.

Samples are clipped from each wire coil arriving at the plant and forwarded to the chemical laboratory as the first step of "in-plant" core-wire control. Electronic and wet chemical methods are used to verify information attached to the wire coil and contained in certifications forwarded by the steel producer.

Coating Ingredients

Knowledge of the specific chemistry of each individual heat of core wire becomes an important tool in quality control. Each batch of coating thus is tailor-made to fit the specific heat of wire being coated.

An electrode coating may be a blend of a dozen or more inorganic oxides, natural minerals, synthetic minerals, powdered metals, powdered ferroalloys and liquid binders. The number of types, grades and color of such materials used by a single electrode manufacturer may run into the hundreds.

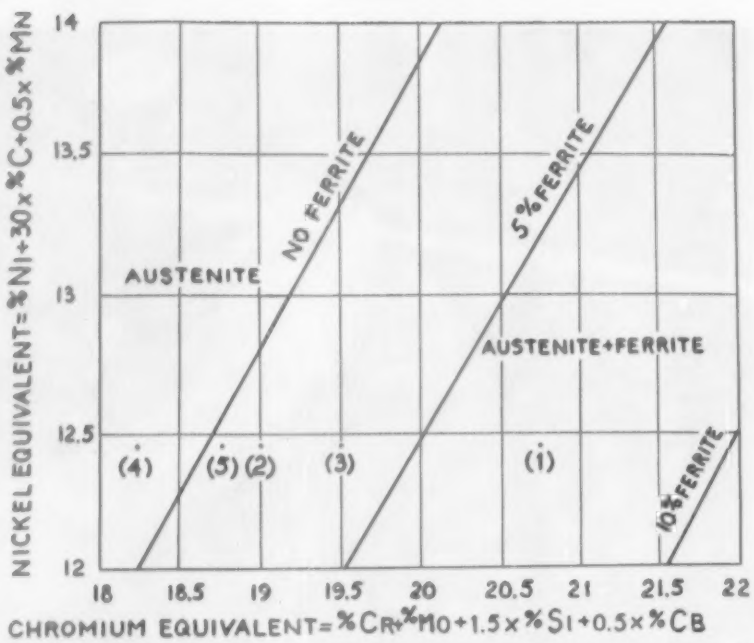


CHART indicates theoretical composition structures of weld metal deposited by lime- and by titania-coated stainless electrodes. Normal alloy losses are taken into consideration. (From Metal Progress, Nov., 1949).

Each of this vast army of materials has specific physical and chemical characteristics. Routine quality control testing must see that each shipment of every material conforms to established standards. These standards will include purity, color, particle size distribution, reactivity with alkaline silicates and binder absorbtion factor. Undetected variations in uniformity of powdered materials could adversely affect welding characteristics of the finished electrode.

Laboratory Instructions

Production controls start with initial handling of materials in the weighing operation. Recording scales indicate addition of various ingredients and the printed record becomes part of the permanent batch history.

Flux ingredients are added in accordance with established formulations. Powdered metals and ferroalloys are added to the batch in accordance with instructions to production from the chemical laboratory.

Laboratory instructions take into consideration alloy losses associated with the type of coating being prepared and the size of wire to be coated. The additions also are matched to specific analysis of the wire to be coated, taking into account variations in composition of wire within the already rigid specification limits of purchase specifications.

Each factor is of vital importance if analysis and structure of the weld deposit are to meet rigid commercial specifications with pinpoint accuracy.

The far-reaching effect of this precision production of stainless steel electrodes may be appreciated more fully by examining a typical weld deposit. Assume that one lot of 3/32-in. and 3/16-in. wire of Heat XYZ, Type 308 wire is to be coated with lime-type coating, and the remainder with a titania-type coating.

Assume further that Heat XYZ wire has the following chemical composition, and that normal alloy losses are encountered.

Element	Amount (%)
Carbon	0.05
Chromium	20.00
Nickel	10.00
Manganese	1.80
Silicon	0.50

Theoretical composition structures of weld metal deposited under these conditions by tailor-made and by run-of-the-mill electrodes are summarized in Fig. 1. Point 1 illustrates

approximate composition of weld deposited by precision-made electrodes *irrespective of electrode size or coating type.*

Points 2 and 3 represent possible structure of weld metal deposited, respectively, by 3/32-in. and 3/16-in. lime-coated electrodes which contained no compensating alloy additions. Points 4 and 5 illustrate possible structure of weld metal deposited by 3/32-in. and 3/16-in. titania-coated electrodes without any alloy fortification.

Over-all difference in chromium content of the five weld metals deposited by electrodes made from Heat XYZ core wire is more than 2%. Such normal variations in chemical composition of weld deposit emphasize the necessity for adequate controls and individual batch formulation in the production of stainless steel electrodes.

Control of Coating

Coating of the desired composition, mixed to a proper degree of plasticity, is extruded around the core wire under hydraulic pressure in a conventional manner.

Skilled press operators are responsible, to a large extent, for eccentricity control of electrodes as they emerge from the die block. These men make and record eccentricity test results at least once every five minutes.

Many additional check tests are routinely performed at shorter intervals, because electrode concentricity is a basic prerequisite for ease of operation and uniformity of burn-off.

Production line inspectors stationed before and at the completion of the drying cycle evaluate general appearance of electrodes. Electrodes damaged by conveyor belts, hold-down pads and brushing equipment, or those cracked during the drying cycle, are rejected and set aside for later core-wire salvage operations.

Salvaged core wire retains the original heat identification for use in subsequent re-coating operations.

Performance Controls

Performance control may be classified as operational and weld metal evaluations. Skilled test weldors select electrodes at random from the production line several times per hour.

These electrodes are tested in all positions, with direct or alternating current as electrode usage dictates. Test weldors have authority to reject all lots of production material which, in their opinion, has sub-standard operating characteristics, and to halt production until the cause of the defect has been rectified.

40 years of service . . .

WELDING ENGINEER is proud of its 40 years of editorial service to the welding industry.

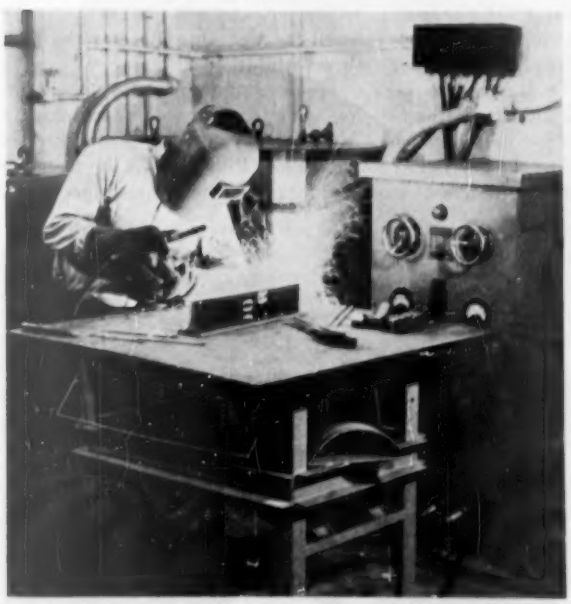
Don't miss the January anniversary issue that marks the start of our 41st year.

Long-range studies of weld metal properties are less dramatic, in many respects, than rapid-fire, production-line controls. At the same time, however, the importance of such a co-ordinated program of weld metal evaluation cannot be over-emphasized.

Chemical analysis of quality control weld deposits check the accuracy of theoretical weld metal compositions determined from empirical data on alloy losses and recoveries.

Metallographic examinations, among other studies, double-check the dependability of theoretical ferrite approximations. Tensile test, impact, bend test and corrosion specimens—all are used to evaluate performance of weld metals in various types of service applications.

Stainless steel electrodes today are precision designed and produced to meet the most exacting demands of modern industry for rigid control and outstanding performance.



USABILITY tests are made frequently with electrodes picked at random from production line. Test weldor can reject sub-standard lots or halt production to rectify a defect.

ADDITIONAL quality control tests include this microscopic examination of stainless steel weld deposits. Tensile, impact and bend tests, and corrosion studies are also used.

Philadelphia has gained world renown as the cradle of American independence. Its inspiration still lives to help important national groups like the American Welding Society develop . . .

ABOVE: Lincoln Gold Medal winner Nikolajs Bredzs (right) shows his award and the certificate to James J. Powers, Jr., and Frank W. Hussey, metallurgists at Frankford Arsenal, the sponsor for Mr. Bredzs' project.

New ideas from an old hearth

BY F. T. TANCULA

PHILADELPHIA has many claims to fame, and not the least of them is its renown as the friendly Quaker City. This warm spirit was emphasized when the city played host for five days in October to the American Welding Society's national fall meeting.

Hotels were crowded, and AWS headquarters—the Bellevue Stratford—especially so. This stately old hotel, *grande dame* of Philadelphia hostelries, was undergoing some face-lifting, but even this minor inconvenience failed to dampen the visitors' spirits.

The historical sites, the famous dining rooms . . . these and many other tourist attractions lured the usual number of visiting firemen and their wives. But it wasn't all play—there was plenty of work.

Some Delayed

Heavy rains, which inundated much of the same area hit by Hurricane Diane less than three months previously, delayed the arrival of many New England, New York and New Jersey delegates, but most of them managed to get through by late Monday night. Total registration for the Oct. 17-21 affair was 1,151.

This was the next-to-last fall meeting for AWS; next year's get-together in Cleveland will be the last to be held in conjunction with the National Metal Exposition. (See the story on this year's Metal Show in this issue)

Society President Joe Humberstone of Air Reduction Sales Co., whose extended term of office expires next May, confirmed at the business meeting Wednesday afternoon that AWS has cancelled its contract with the Metal Show.

The handful of persons attending the business meeting also heard Mr. Humberstone give a glowing report about the growth of the spring welding show.

The success of the second show made Buffalo a logical choice for a return engagement, he said, as he listed the definite dates for the next three exhibitions.

Besides Buffalo next May, the welding show will be in Philadelphia in April, 1957, and in Milwaukee in May, 1958. Pittsburgh is the tentative site for the 1959 exposition, which

SEEN touring the Metal Show were John J. Chyle, who received this year's Samuel Wylie Miller Memorial Medal, and Fred Plummer, immediate past president of AWS.

HONORARY Membership Award winner William Spraragen (left) receives congratulations from C. I. MacGuffie of General Electric Co.'s Welding Department.

also will be held in May.

A good-sized crowd, although certainly not a capacity one, was on hand to hear Mr. Humberstone make his welcoming address after the convention was officially opened by Walter Goerg, Jr., national convention committee chairman.

Although Mr. Humberstone's remarks were optimistic on the present and future of welding, he reminded his audience that there are many things that could be welded right now but are not.

"Welding has demonstrated a higher degree of adaptability to mechanization with wider applications than previously thought possible," he said. "But let us not overemphasize the new . . . I submit that the oxyacetylene flame will never grow old . . . the stick electrode will continue to be used . . . and small job shops will not become extinct."

As Mr. Humberstone termed it, "This is the golden age of welding."

Miller Medal

At the National Dinner which followed the highly successful President's reception, J. J. (Jack) Chyle, first vice-president of AWS, was awarded the Samuel Wylie Miller Memorial Medal—the Society's highest honor—for his contributions to welding.

Director of welding research for A. O. Smith Corp., Milwaukee, Mr. Chyle has invented and patented a number of welding electrodes and processes. He is credited with developing in 1927 the first extruded, all-position electrode—now classed as the E6010. In 1951, Mr. Chyle was the Adams Lecturer.

(To help WELDING ENGINEER *celebrate its 40th anniversary, Mr. Chyle will present* "A short history of the coated electrode" *in the January, 1956, issue.)*

This year's Lecturer, LaMotte Grover, welding engineer for Air Reduction Sales Co., received his certificate at the dinner. The topic of Mr. Grover's talk, which was the 13th Adams Lecture, was "An Interpretation of Research and Experience in Structural Welding."

Prior to joining Air Reduction 16 years ago, Mr. Grover served several years as bridge engineer for the Kansas state highway commission. During World War II, he was closely affiliated with the control of welding in the shipbuilding industry; he served on advisory committees of the American Bureau of Shipping and the U. S. Maritime Commission.

Membership Awards

A faithful servant of the Society for many years was recognized for his loyalty to the organization and for his eminence in welding when William Spraragen was presented with an Honorary Membership.

Now director of the Welding Research Council, he was also editor and business manager of *The Welding Journal* from 1922 to 1955. But his association with the welding industry dates back to 1918 when he was appointed research assistant to the welding research committee of the National Council of Defense and Emergency Fleet Corp.

In 1940, Mr. Spraragen was the Samuel Wylie Miller Medalist.

The Henry Neitzel Membership Awards this year went to Houston and Toledo. For the fourth time in six years, Houston won the numerical award—its gain this year was 64 members, nine more than the second-place Philadelphia section.

Toledo's percentage gain of 46.3 beat out Kansas City, which had a 43.8% gain in membership. This is Toledo's second win in the percentage category.

TWO award winners — Nikolajs Bredzs (left), who received the Lincoln Gold Medal, and Monroe Edwards, first-place winner in the A. F. Davis Undergraduate Awards.

One of the honored guests at the reception and dinner was Dr. C. A. Adams, first president of the Society and welding pioneer for whom the Adams Lectureship is named.

Undergraduate Awards

Earlier on the opening day of the convention, the Lincoln Gold Medal was awarded to Nikolajs Bredzs, research metallurgist for Armour Research Foundation, Illinois Institute of Technology, Chicago (see WELDING ENGINEER, Nov., p. 5).

Sponsored by J. F. Lincoln, chairman of the board of The Lincoln Electric Co., the medal is awarded annually for the paper judged as the most original contribution to the advancement and use of welding. The top paper is chosen from those published in the Society's *Journal* during the 12-month period ending each July.

Mr. Bredzs' article was entitled "Investigation of factors determining

ABOVE: Crowd at opening session heard President Joe Humberstone's welcoming address, the Adams Lecture, and witnessed award presentations.

RIGHT: Scene from the President's reception.

the tensile strength of brazed joints." He wrote it as part of his work on the study of fundamentals of brazing.

For the past four years, Mr. Bredzs has been project engineer on this study sponsored by Frankford Arsenal, Philadelphia.

The South made a clean sweep of the A. F. Davis Undergraduate Awards this year. "Welding faces automation," which was published in the *Georgia Tech Engineer*, was selected as the top student paper to appear in an undergraduate publication during the year ending June 1. Its author, Monroe Edwards, was on hand Monday morning to receive his certificate and cash award of $200. The publication received an identical sum.

Second-prize winner was William J. Gress, who was unable to be at the convention. His paper, "Welding, a way of thinking," was published in the *Florida Engineer*. He and the publication received awards of $100 each.

These awards are sponsored by the vice-president and secretary of The Lincoln Electric Co., A. F. (Charlie) Davis.

The Tours

Other highlights of the convention, other than those of the technical sessions, included tours of the U. S. Naval Shipyard on Wednesday morning and the Eddystone Division plant of Baldwin-Lima-Hamilton Corp.

The usual committee meetings, some of them closed to the press, were on the agenda, and the annual reports of all were submitted at the general business meeting.

Plans are already in full swing for the 1956 Spring Technical Meeting and the Fourth Welding and Allied Industry Exposition in Buffalo. Remember the dates: May 8 through 11 for the technical meetings; May 9 and 10 for the welding conferences, and May 9 through 11 for the welding show.

♦ ♦ ♦

The technical sessions . . .

TO PARAPHRASE Francis Bacon: some papers are to be tasted, others to be swallowed, and some few to be chewed and digested.

Although WELDING ENGINEER would prefer to "chew and digest" the more than 60 papers that were presented at the fall meeting of the American Welding Society, space limitations make it necessary only to "taste" some of them.

Top attraction of the Oct. 17-21 session, of course, was the Adams Lecture. The honor of presenting the 13th in the series went to LaMotte Grover, welding engineer, Air Reduction Sales Co., New York City.

Mr. Grover's talk was entitled "An interpretation of research and experience in structural welding." Paying particular attention to the brittle fracture problem in carbon-steel structures, he compared the plastic behavior of structural members with the conventional elastic theory.

Structural welding is still having growing pains, he told the several hundred persons attending the session, and thousands of tons of steel are being wasted annually in construction.

As for welding being blamed for brittle fractures, Mr. Grover said studies have shown that since the advent of welding there has been no evident increase in the number of such fractures in non-ship structures."

As was to be expected, the use of carbon dioxide as a shielding medium in Mig (metal inert-gas) welding was again a topic of considerable interest, judging from the turnout at the session on Monday afternoon.

CO_2 Still in Spotlight

A paper by Robert J. Keller and John P. Koss, A. O. Smith Corp., Milwaukee, discussed the requirements for successful application of the process from the standpoint of material and wire compositions.

While it is believed that CO_2 has a great future as a shield for welding mild and medium-carbon steels, the authors pointed out that the process is not a panacea for all welding problems.

Some of the requirements to consider: fit-up, jigs and fixtures, steel composition, welding position, plate thickness, welding procedure and economic survey. The economics, though last named, is far from being least in importance.

A large number of identical or at least similar parts must be available for welding if any automatic process is to be economically feasible.

Moisture Effect

In his paper, "Moisture and its effects in carbon dioxide welding of steel," Roger Tuthill, General Electric Co., told of investigating a wide range of moisture contents. His observations indicate that when using carbon dioxide, the moisture content directly affects the porosity content of the weld.

Two other G-E men, Robert D. Mann and Julian D. Carey co-authored a paper on electrode characteristics for welding mild steel by the CO_2 Mig process.

The other prime attention-getter of the last two years also stayed in the limelight. The iron-powder electrode was the subject of three papers delivered Wednesday morning.

Electrode Modification

Ernest DiLiberti, Air Reduction Sales Co., told how the starting characteristics of the iron-powder electrode have been modified because the weldor often would get an arc when he didn't want it.

Mr. DiLiberti touched upon the reason for some of the confusion regarding speed of this electrode type. Although speed is considered its top characteristic, it must be remembered that it is of little consequence if the same number of workpieces are produced in a given period by the weldor.

D. C. Smith, W. G. Rinehart and D. C. Helton, all of Harnischfeger Corp., Milwaukee, collaborated on a paper describing the properties and applications of low-hydrogen, iron-powder electrodes. The presentation was by Mr. Smith.

Their summary: tests show that the

30% iron-powder-modification electrode has from 20 to 30% greater deposition rate, and the 50% modification, from 60 to 80% greater deposition rate than their conventional counterparts when used at optimum welding current.

The rate of actual moisture absorption by the non-metallic materials in the coating of this type of electrode, in general, is greater than conventional types, and equal precautions should be observed in storage and care.

Surface Tension

The third paper discussed the effect of individual coating ingredients on surface tension of iron electrodes. Authors were Thomas H. Hazlett and Earl R. Parker, University of California. They described studies made to determine the ingredients' effect on the surface tension of molten mild steel.

Determinations were made by the "drop shape" technique, which relates geometry of the drop to surface tension, and were made in helium, argon and nitrogen.

The session on welding equipment Tuesday afternoon was led off by a paper describing the characteristics of a rectifier-type, constant-voltage power supply. Jesse W. Pomazal, Harnischfeger Corp., was the author.

This welder uses a main power transformer in conjunction with a special regulating magnetic circuit to provide an output voltage that remains constant for a wide range of output current. Principal advantages as enumerated by Mr. Pomazal: no moving parts, reduced idle losses, ease of additional "packages" to give greater flexibility in use of equipment.

A number of 500-amp machines has been in service for several years, with good performance records, according to the author. Combinations of these units in groups of two or three assembled in a single enclosure have been made for locations where load conditions are predictable, whereas seperate machines are sometimes preferred where load conditions vary greatly.

A paper by Gordon S. Wepfer, A. O. Smith Corp., explained development of high-tensile, high-impact electrode. The recent development of low-alloy, high-tensile steels and the continued demand for satisfactory electrodes for welding armor plate led to the work.

Various combinations of alloys using a low-hydrogen type of coating were made and tested. Three different electrodes were developed with satisfactory properties in both the as-welded and stress-relieved states.

Resistance Welding

The resistance-welding field also garnered its share of devotees when three papers were delivered the first day and several others throughout the week.

An extensive program of developing schedules for welding projection hardware (brackets, angles, bolts, etc.) to low carbon-steel was described by O. K. Barnes, Jr., Westinghouse Electric Corp.

Another Westinghouse man, Julius Heuschkel, was chosen to deliver the educational lecture series on Tuesday and Wednesday afternoons. His topic: mechanical properties of steel weld metals. In addition, Mr. Heuschkel was the author of a paper delivered on Tuesday morning that concerned the lattice structure influence upon strength - ductility - temperature relationships.

John F. Rudy, Wright Air Development Center, and Roy B. McCauley, Ohio State University, explored the relationship between the macroscopic cross-section of a spot weld and its physical properties. The ultimate strength of a spot weld was found to depend upon the formation of a cast nugget and upon the size of the nugget when formed.

Aluminum and Copper

Two men from Kaiser Aluminum and Chemical Corp. presented a paper entitled "Welding aluminum to copper using the Mig process." L. A. Cook and M. F. Stavish told how the increasing use of aluminum bus bar for elevated temperature service in combination with existing copper systems has emphasized the need for a method of arc welding aluminum to copper.

Their method: the portion of copper to be joined to the aluminum is first coated with a silver solder by means of standard silver-brazing procedures. The conventional Mig process is then used to weld the aluminum to the coated copper.

The silver solder acts as a buffer layer to prevent excessive formation of brittle $CuAl_2$ during welding. These Mig-braze welded joints are ductile and have good mechanical properties and electrical conductivity, according to the authors.

ADAMS Lecture—the 13th—was delivered by La Motte Grover.

An explanation of contour beveling and welding through the use of an electronic tracer was given by Howard B. Cary, Marion Power Shovel Co. His co-author R. F. Helmkamp, Air Reduction Sales Co., conducted the discussion after presentation of the paper (see elsewhere in this issue, "Contour beveling and welding").

Omer Blogett, The Lincoln Electric Co., spoke on design Friday morning. He gave data on how to use steel effectively in machinery.

Free Discussion

The technical sessions also included some actual application-type papers, *e.g.*, "Offshore Drilling Barges," by Robert H. Macy, Ingalls Shipbuilding Corp.; "Fabrication of crosshead beams for the world's largest hydraulic press," by V. M. Nigring, The Midvale Co., and "Welding of structural steel for Hartford Library" by Carl L. Kreidler, Lehigh Structural Steel Co.

Only one paper on the program was not delivered, although some had to be read by persons other than the authors. On Wednesday afternoon the session conducted by Fred Plummer had both author and paper missing.

So Chairman Plummer called for a discussion from the floor. About 100 persons were in attendance, and they responded with a lively discourse that lasted almost an hour. The subject was that of the scheduled paper: the practical approach to welding of stainless-steel pressure vessels.

AMONG the newest products displayed at the Exhibition was this radiographic unit distributed by Metal & Thermit.

PORTABLE X-ray equipment was displayed by a number of manufacturers—in fact, industrial radiography (of both the radioactive-isotope and X-ray varieties) more than held its own, despite competition from so many other types of products. This is the Andrex booth.

Interest never waned . . .

At the Metal Show

By a Staff Member

THE giant 37th National Metal Exposition covered about six acres of floor space in Philadelphia's Convention Hall and Commercial Museum, near the campus of the University of Pennsylvania.

It represented the most complete show of equipment and materials in the metal-working industry.

Welding played an important part in this $15,000,000 Metal Show, but it took an entire day to see all welding-equipment manufacturers' booths because they were spread around the entire exhibition space.

Total attendance clocked for the five-day show, which ran from Oct. 17 through 21, was 56,953.

Next year's Metal Show in Cleveland will be the last in which the American Welding Society participates. After that, the main attraction for the welding industry will be the annual welding show held in conjunction with the AWS Spring Technical Meeting.

The line-up: Buffalo in 1956; Philadelphia in 1957; Milwaukee in 1958.

Here is a candid cross-section of those who displayed products during this mammoth show and those who visited their booths.

THESE smiling visitors to the Westinghouse booth were probably surprised to hear technical explanations about welding machines come from the lips of this pretty young model.

DOLLAR bill (it was phony) was used to demonstrate powerful suction created by Torit dust collector.

ITS new line of automatic submerged-arc equipment was demonstrated by Lincoln (see WELDING ENGINEER, Oct., p.91) before crowds similar to this one.

HEAVY-duty torch manufactured by Smith Welding Equipment Corp. cut through four thick slabs of steel that were separated by small-diameter wire. Another crowd pleaser.

PROBABLY the tallest exhibit at the Metal Show was this blast-cleaning device manufactured by Wheelabrator.

TWO rings, seemingly in perpetual motion around the can (center of photo), caused many a passer-by to stop at the Oakite booth.

CONTROLS for welding machines—both resistance and arc types—were demonstrated by Weltronic. Here an Air Reduction automatic Tig welding head is used in conjunction with the former's equipment.

AUTOMATIC set-up was used by Coast Metals to show off its line of hardfacing alloys.

ONE of the newest of new products displayed was Linde's new Tig (tungsten inert-gas) cutting process and apparatus for non-ferrous metals (see "Big switch makes Tig torch a cutter," WELDING ENGINEER, Nov., p. 51). When demonstrations were going on, crowds like this were common.

HARPER W. Snyder, who developed the repair techniques for rock drill bits and striking bars, inspects a repair on one of the latter. New bar is formed from parts of two broken ones.

$65 drill bits get $2 repairs and a new life

BY HOWARD GANS*

TUNGSTEN carbide inserts are badly chipped and broken on this 4-in. bit. Circular torch tip gives uniform preheat

BONDED to drill bit with a high-strength, thin-flowing alloy, tungsten carbide inserts now give broken drills 100% new life

ONE of the biggest rock drilling operations in the country is being conducted jointly by L. G. DeFelice & Son, Inc., and C. J. Langenfelder & Son, Inc., in the Westchester section of the New York State Thruway. This superhighway eventually will link Long Island with Buffalo.

Construction work on this section of the expressway has necessitated extensive rock drilling. This has presented many problems, not the least of which has been the repair of tungsten-carbide-tipped drill bits.

The wear on these bits is very rapid due to the hardness of rock encountered in this area. Formerly, when a carbide insert broke, it represented a complete loss because the manufacturer had recommended replacement rather than any attempt at repair. The 4-in. bits cost approximately $65 each.

Destructive Factors

Breakage is the fault of the operation and the rock formation. If it were possible to determine the relative sharpness of bits during drilling, a bit could be withdrawn immediately it required resharpening.

Composition of the rock determines this factor, and a hard section causes accelerated wear upon the carbide tips. When tips become blunt, cutting action is lost and the bit pounds against the rock. When the impact load becomes too great, the tungsten carbide shatters.

Bits operate at extremely high pressures, and to the weight of, say, 30 ft. of drill steel must be added the 600-lb drill head to which the drill steel is connected. The load is further increased by many hundreds of air hammer blows per minute at 80 to 90 psi of air pressure.

Many attempts were made to repair these bits. The inserts, however, would fail after a varying depth had been drilled, and when the bit was withdrawn the tungsten carbide inserts remained in the hole.

Irrespective of depth, the hole had to be completed or abandoned because inserts remaining in the hole prevented a bit cutting deeper into the rock. It was a case of trying to cut through tungsten carbide with a tungsten carbide drill.

Harper W. Snyder, who is responsible for much of the maintenance work on welding equipment, finally devised a means of repairing these bits. Operational costs have been reduced by as much as $1,100 in a two-day period as a direct result of this repair technique.

New Heating Tip

When drills with chipped or fractured inserts are brought to the maintenance department, they are thoroughly cleaned with a power-driven wire-brush. The threaded end of a discarded steel drill is bonded to a bench. The bit is screwed onto the threaded portion, which holds it steady during repair.

*District engineer, Eutectic Welding Alloys Corp., Flushing, N. Y.

Uniform preheating is essential because uneven expansion and contraction cause joint failure and loss of inserts during drilling operations. A multi-flame circular tip was devised to solve this problem. Consisting of a circular copper tube with four outlets evenly spaced around its inner circumference, the unit is bonded to the stem of a regular oxyacetylene torch tip.

The multi-flame tip permits rapid, uniform heating. The bit is heated to approximately 1,100 F, using an acetylene pressure of 25 lb (which obviously exceeds the safety factor and is therefore not recommended by WELDING ENGINEER) and an oxygen pressure of 90 lb. This adjustment has proven most satisfactory.

Defective inserts are removed with channel lock pliers and the heated grooves are thoroughly cleaned. Wire brushing will remove most of the remaining joining alloy, but a special scraper was designed to insure complete cleanliness. This scraper, a carbide tip joined to the end of a drift, removed all foreign matter from grooves and left a perfect bed for inserts.

Seating of Inserts

When thoroughly cleaned, a temperature-indicating powdered flux was placed in the grooves. The same flux, in paste form, was applied to the replacement insert. The insert was placed in the groove and the area broadly heated with an oxyacetylene torch. Gas pressure was adjusted to approximately 15 lb acetylene and 40 lb oxygen. A No. 5 tip was used.

The heated end of the bonding alloy rod was dipped into powdered flux and applied to the upper joint area. When the alloy appeared at the bottom, it indicated complete flow through the joint.

This same procedure was used to bond remaining inserts into position. When completed, the bit was covered with asbestos and allowed to cool slowly. Upon cooling, the bits were ground to the desired dimensions.

This process is being used to repair 50 4-in. bits and 50 2½-in. bits per week. The technique has been improved until the life of the repaired bits now equals that of new bits.

Cost studies indicate that a great saving can be made if this procedure is followed with a correct bonding material. Labor (30 minutes for each bit) is rated here at $1.50; 0.017 lb of alloy and flux per bit cost 26 cents; cost of oxygen and acetylene used for each bit is 25 cents.

The complete repair bill, then, for a 4-in. bit costing $65, is $2.01!

Striking Bar Repairs

The 4-in. striking bars, like the bits, always presented a repair problem. Service life of new bars is several hundred hours, but repaired bars rarely last more than 30 hours before failure occurs. Sometimes, 5 hours is the maximum life obtained.

Many different materials and procedures were tried to improve this condition. Stainless steel electrodes and low hydrogen electrodes were used, but with little success. The scrap heap was piled high with welded failures until a process was evolved and an electrode developed which provided adequate strength to the bars.

A striking bar usually breaks near the "ears" at the side nearest the larger end. A repair cannot be made at this point, so it is necessary to construct a bar from pieces of two defective ones.

When internal threads of a striking bar become worn, the bar is no longer serviceable. The long shank, however, has much more useful service life remaining.

Skip-Welding Technique

This shank is removed from the threaded portion, and the threaded end is removed from a broken striking bar. When the two are joined, the unit will last until inside threads are completely worn out.

After cleaning the two sections with a power-drive wire brush, the edges are beveled to an approximate 90-deg angle. A dowel is inserted to maintain alignment, and the units are positioned in a rotating jig.

WITH root beads applied, weldor starts metal build-up on broken striking bar. Heat is kept to a minimum throughout operation

The d-c welder is set at 100 amp, reverse polarity, and one complete pass around the root of the vee is made with a ⅛-in. diameter high chromium-nickel coated electrode. Skip-welding technique is used throughout the operation to prevent a local buildup of heat. Alternate work on four or five bars at the same time allows deposits to cool before further applications.

When the root bead has been applied, the amperage is adjusted to 120, and with a 5/32-in. diameter electrode, two complete passes are made with the same skip-welding technique.

Following this, one-quarter of the bar's circumference is built up level with the top of the vee. The striking bar is then reversed and the opposite side receives similar treatment.

Deposits are in the form of stringer beads applied perpendicular to the shaft. Operations are never resumed until the bar has cooled to a comfortable hand-heat.

Final Filling

When the bar has cooled, remaining spaces are filled with a 3/16-in. diameter electrode (140 amp). Filler metal is deposited flush with the top of the vee, and the weldor then weaves one pass completely around the joint.

This final pass, which builds the deposit above the level of surrounding metal, gives the joint strength characteristics necessary to withstand operating conditions. Heat is kept to a minimum throughout the entire operation, and at no time is the blue heat-color permitted to travel more than half way between joint and ears.

A continuous repair program is maintained, assuring an available supply of repaired striking bars for any emergency.

New procedures, taking advantage of alloys and electrodes especially formulated for such operations, have been responsible for saving the companies involved many thousands of dollars. They have prevented "downtime," and have enabled contractors to keep ahead of work which is so vital if the Thruway is to be finished on schedule.

RIGHT: Badly-damaged grader frame had to be straightened and narrowed to seat new power unit. Grader blade was put on blocks to take excess weight off side frames.

LEFT: Heat was applied to key points A, B and C, one at a time, and force was used to aid the upset of heated metal. Job was a success, and the grader has since seen constant service.

FLAME-STRAIGHTENING—Part II

A friend in need

BY JOSEPH HOLT

AT TIMES, when an operator is applying a heat, a warpage or increase in the amount of bend occurs. This is caused by conducted heat which radiates to adjacent metal.

This warpage need not be seriously considered, although after a little practice the operator can use this additional expansion to advantage. All the beginner needs to consider is the metal which is heated enough to upset, unless there is an excessive weight or stress on the member being heated.

If there is excessive weight or stress, it must be relieved or it will stretch the heated metal. This, however, is unnecessary under normal circumstances. There is usually enough rigid metal to support considerable weight or stress.

A heat, though properly applied, sometimes does not pull as well or as much as it should. There may exist internal stresses which the first heat will only relieve. A second heat will be required to do the pulling.

Then, too, there are many bends that will respond to very little heat. Practice alone can make the operator a good judge of these conditions.

The better grades of steel are heat-treated. When straightening such a member, keep in mind the fact that heat will anneal, or soften it. If annealing weakens the steel and drops it below the standards set for a particular use, some reinforcement must naturally be added to offset this weakness.

If a bar, angle or any other steel shape is added for reinforcement, weld on the edges only. Never weld crosswise on a member unles absolutely necessary.

Some Applications

Ordinary mild steel members need no reinforcement unless subjected to excessive stresses. On such structures as bridges, which always receive vibration or reverse stresses, it is advisable to reinforce.

A heavy, 10-in. I-beam, which was used as a boom, was bent in service and posed a seemingly difficult task for a small shop. It was straightened with nothing but oxyacetylene heat, properly applied.

This I-beam responded readily to the contraction method, and the only force used was its own weight. The beam was not moved from its position during the process. This eliminated handling costs which, under the circumstances, would have been more than the cost of gases used.

Heating Time

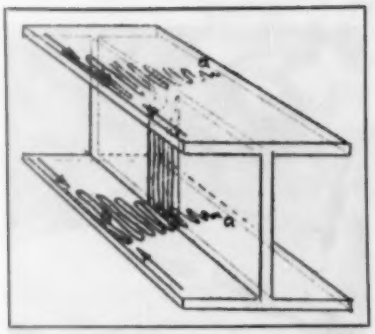
Time required to heat the beam was no greater than that necessary to make a single heat in a forge, where at least three heats would have been required. Torch heat was applied only to the necessary spots, thus avoiding all short kinks and physical exertion.

Starting at the bottom of the I-beam, the heat was widened in a V-shape toward the top on both flanges. The web was heated all the way across, so that the entire heat was in a V-shape from bottom to top through the entire member.

Do not over-heat! In a case like this, where weight of the member is assisting the heat, changes in alignment take place very rapidly and it is easier to re-heat than to pull the member back.

No area should be heated to such an extent that the weight of the member will cause it to sag. Let con-

This article concludes a two-part series based on the book "Contraction as a friend in need," which was copyrighted by Mr. Holt in 1938.



WEB of an I-beam to be bent sidewise is heated to the same width as the heats on the flanges where they join the web.

traction pull it into desired shape for a perfect job.

Dipper-Stick Bends

On power shovel dipper-sticks, a bend will usually be a gradual one and will occur some distance from the boom. It is advisable to apply the first heat at the highest point of the bend. All heats on dipper-sticks should be in the form of a narrow V and should be made very rapidly.

There is usually an internal stress which a small heat will relieve. Also, many dipper-sticks are filled with hardwood which must not be weakened.

After the first heat has cooled, it is easy to see where to apply the next. Several heats may be required in many different places, depending upon conditions in a particular dipper-stick.

On a bent dipper-stick treated by the author, the top and bottom were both heated with the widest part of the V at the outside, or point of the bend. The outside was then heated to the same width all the way across to complete the V.

Less than half an hour was required to make all three heats necessary to straighten this stick and the shovel was ready for immediate use. To have done this in any other manner would have required considerable time and money.

Truck frames are often bent from overloading, striking ruts in the road or collision. A case in point is a truck that was hit head-on while carrying a full load (illustrated in WELDING ENGINEER, October, 1955, p.44).

The frame was bent downward and sidewise just back of the cab, leaving the front of the frame 15 in. out of line on the vertical and 8 in. out of line on a horizontal plane. There were several small kinks, and from the main bend forward the frame was in a diamond shape, with double bends in the two front cross-members.

In this case, the truck was stripped because of necessary repairs to the cab, engine and transmission, making straightening an easier job. The two cross-members, already loose, were removed so that each side of the frame could be handled separately.

Contraction Process

The members were first heated for horizontal straightening. One was heated on the flanges, starting at the web. The other, being bent the opposite way in regard to channel shape, was heated in a reverse manner.

After horizontal straightening, the members were heated to bring them in line on the vertical. The top flange was left cold, and the heat was started on the web next to it and widened as it reached the bottom. The bottom flange was heated to the same width as the heat at the bottom of the web.

A hammer was used only to flatten the web or flanges where they were kinked badly over short distances, and then with as little heat as possible. No force, other than contraction caused by properly applied heat, was used to pull the frame into proper alignment.

On this job, the frame was reinforced with a mild steel plate $\frac{3}{8}$-in. thick. This plate was placed inside the channel and held in place by welds on the edges, together with a few rivets in holes which were already in the frame. This truck has now been back in service for some time and performs very satisfactorily.

Heat-Treated Frame

Other truck frames have been repaired without dismantling, but care must naturally be taken if heat is applied near the gas tank. Also, a frame bearing a great deal of weight should be blocked or jacked to prevent sagging if too much heat is applied.

A badly-damaged grader frame, from which the totally destroyed power unit had been removed, had to be straightened and adjusted to take a new power unit. Distance between side frames was 52½ in., but for the new unit the distance required for seating was only 30 in.

This meant that more than half of the frame had to be pulled in 11¼ in. on each side, and the rest of the frame had to be heat treated until both sides were once again parallel. Excess weight was taken off the side frames by lowering the grader blade onto blocks.

Added Force

Key points were then heated one at a time and force was added to assist in upsetting the heated metal. This saved time and gases, since the web of the channel was ½ in. thick and would have required several heats.

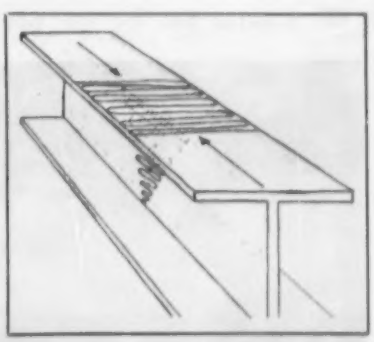
On a job of this type, heat is added only where needed and the result is a strong bend—compared with one made by any other method which would stretch the metal in places and weaken the bend.

A bridge batter post which had been struck by a heavy load of logs was bent upward 4⅞ in. and outward 3⅝ in. The entire post was handled as a single channel, and several heats were required to bring it into proper alignment. Each heat was a narrow V, made as rapidly as possible with two torches.

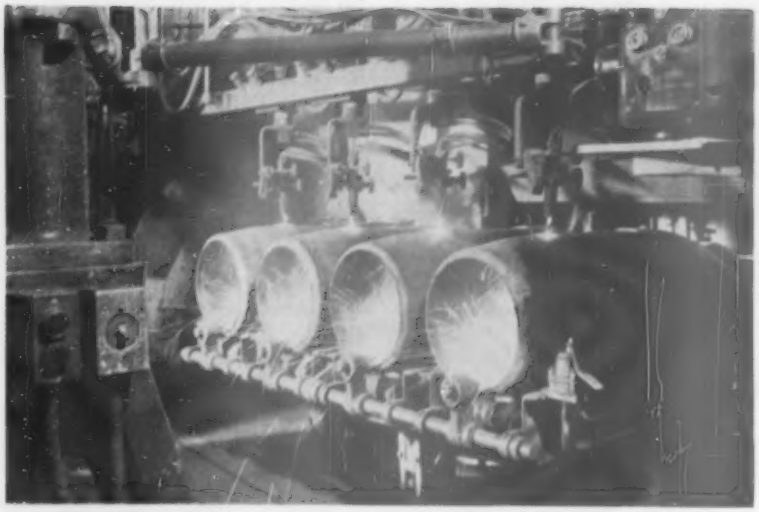
A channel reinforcement was welded in, one on each side. Traffic was not stopped (except for heavily loaded trucks) when a heat was being made. No truck was delayed over ten minutes.

Mastering the contraction method thoroughly can prove invaluable to every torch operator. By applying it to all heats and welds, many difficulties will easily be overcome.

Contraction is not an enemy, but a friend, if you study and understand it.



IN bending an I-beam *edge-wise*, heat web in a vee-shape toward one set of flanges, then continue heating on flanges.



CONTOUR beveling in progress on four steel casings. Torches are mounted on the operating bar of a cutting machine.

COMPLETED flame-cuts are shown in 5/8-in.-thick casings. These holes receive special insert lugs to facilitate handling.

Electronic tracer allows automatic . . .

Contour beveling and welding

BY R. F. HELMKAMP and J. W. CUNNINGHAM*

A UNIQUE, multiple-torch, contour beveling and contour welding installation at Walsh Construction Co., Portland, Me., points up some remarkable techniques developed by modern industry for high-volume production jobs.

At Walsh, four steel casings at a time are automatically contour welded. This operation is preceded by automatic contour beveling to prepare the joint for welding.

This synchronized use of welding and flame-cutting tools clearly indicates the adaptability of this equipment to automation.

Automatic contour beveling with an electronic tracer is a new development designed to reduce handling and subsequent operations in preparing gas-cut sections for welding assemblies.

Welders in Series

Until recently, automatic machine welding has been the straight-line variety. At Walsh, the production sequence is accomplished on a pentagonal table with five stations, resulting in an unprecedented production rate.

The speed of the operation requires a high degree of accuracy in automatic positioning of casings for both contour beveling and contour welding.

The installation, developed jointly by Walsh Construction and Air Reduction, makes use of four beveling heads at one station and four automatic Mig (metal inert-gas) welding heads at another. The welder barrels and the beveling heads are mounted on the operating bar of an oxyacetylene cutting machine.

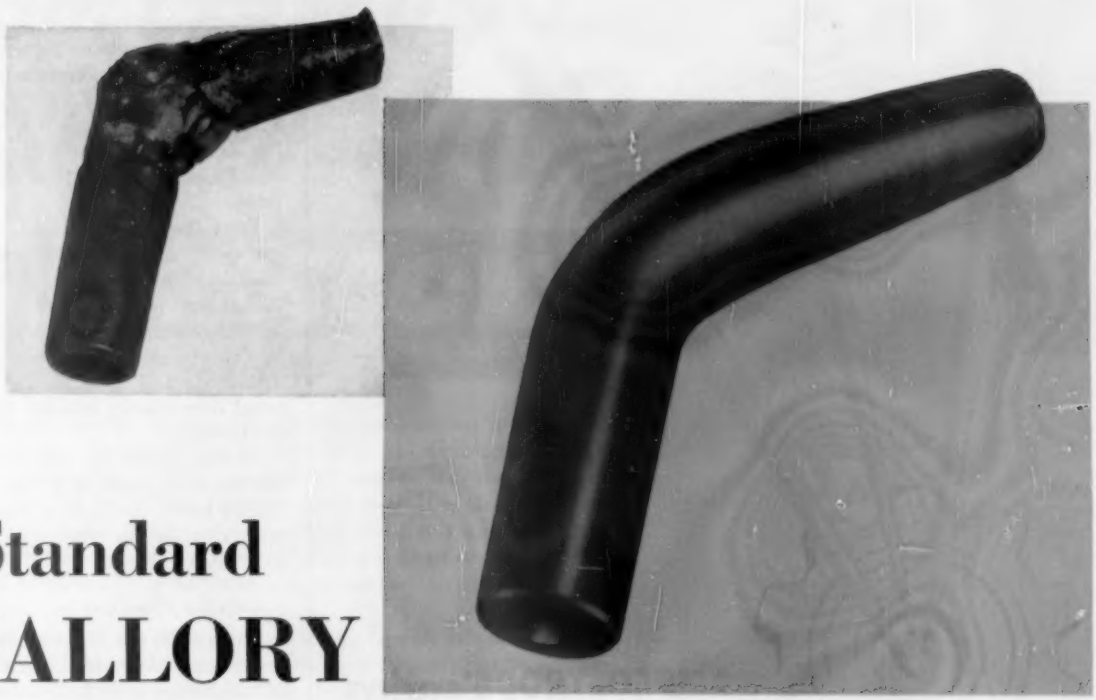
An electronic tracer guides the four beveling heads on one machine, while a magnetic tracer guides the four Mig welder barrels on the other. The head

*Air Reduction Sales Co., New York City.

FOUR Mig welding heads, in series, automatically weld insert lugs in steel casings.

BLIND holes for special handling procedure are now complete. Lugs were tack-welded before final machine weld.

Why "Do It Yourself"?



Standard MALLORY Electrodes *Cost Less, Weld Better*

Makeshift, "home made" welding electrodes can cost more than you realize. Not only do they take a lot of time to contrive, but they seldom have the strength, conductivity and cooling facilities to give good welds and satisfactory life.

Before you "do it yourself," take a look at what Mallory has to offer, in the way of unusual electrode shapes. Literally hundreds of single and double bend electrodes that you may consider special are standard Mallory designs . . . which we can make promptly and economically using existing tool facilities.

Exclusive Mallory cold-forming techniques shape these bent electrodes from full hard rod stock, and develop high hardness and strength far beyond what can be obtained by conventional hot forging methods. Cooling tubes may be bent in place* by a special process, to provide water flow as near to the welding face as in the case of straight electrodes. These extra values designed into Mallory electrodes assure you of long life, long runs between dressings . . . more welds per dollar.

For information on available designs, ask your local Mallory Welding Distributor for a copy of the latest Mallory Welding Catalog, or write directly to us.

*Patent Number 2489993

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. . . give new and better life to worn parts

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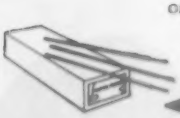
Unique metallurgical qualities, caused by hard, fine aluminum-iron particles (Ampco phase) backed by a softer bronze matrix, help Ampco overlays turn the trick in many severe applications — even where heavy shock loads are present. That's why you can use them for facing bearings, bushings, gears, pinions, and sprockets. You get easy-to-make overlays on cams, valves, wear strips, shafts, etc. And you increase the life of drawing and forming dies many times.

Ampco-Trode can be applied by the metal-arc, carbon-arc, MIG, TIG, and submerged arc processes, as you wish. Increase your productive time and reduce your downtime. Order Ampco-Trode from your nearby Ampco distributor or write us.



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motors for the latter are stationary above the cutter.

Both welding and flame-cutting speeds average 15 ipm. Once the production sequence is in full operation, both welding and cutting proceed simultaneously on different sets of four casings without a delay.

Here is the sequence at Walsh after the steel casings come off a roll conveyor system leading to a pentagonal table.

Four steel casings, 16 in. in diameter with a ⅜-in. wall, are loaded manually at the first station and locked into position. The pentagonal table is then indexed to the second station and locked in position, with drilled starting holes for the contour bevel cuts exactly beneath the beveling torches.

At this station, lug holes in casings are flame-cut, four at a time, with a 20-deg bevel. One hole is 3-in. in diameter, while the other is a 3 by 11-in. oblong hole.

Lugs for Handling

These holes are designed to receive insert lugs which facilitate handling of finished casings by special equipment.

After beveled cuts are made in the casings, the pentagonal table is automatically indexed to the third station. Here, insert lugs and combination insert lugs are positioned mechanically and tack-welded manually in preparation for automatic contour welding.

Insert lugs are steel forgings with a 20-deg bevel. When they are positioned into the casings, a V-groove is created which provides an excellent joint for automatic contour welding.

Contour beveling such as this demonstrates forcibly the reduced handling in preparing flame-cut sections for welding.

After tacking at station three, the pentagonal table is automatically indexed to the fourth station where the four welding heads, using argon plus 2% oxygen as shielding gas, weld the insert lugs which had been tacked into the lug openings.

The pentagonal table is indexed again and releases four casings to a roll conveyor where they proceed to heat treatment. As the casings move along the roll conveyor, there is a slight pause at the preheat station.

Here the casings are subjected to open-gas flame for preheat of the weldments as a preliminary measure before the final heat-treating process.

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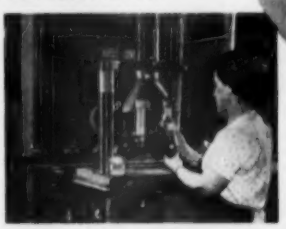
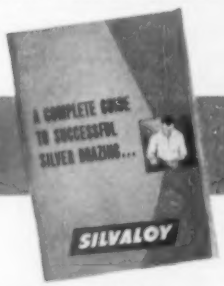
Low temperature Silver Brazing is helping to improve results, speed production and lower costs for manufacturers in many fields. Call the Silvaloy Distributor in your area for complete information or technical assistance. ★ ★ ★ ★ ★



Hex nut is Silvaloy brazed on cap which is in turn brazed to steel body. Air cylinder is used to hold spring-loaded parts in place in induction coil.

ANSUL



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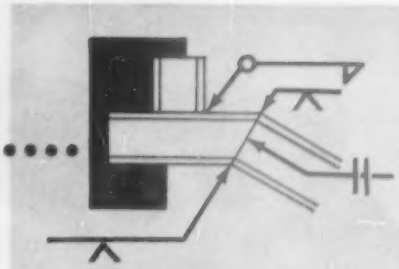


the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

The importance of clean parts

Question:

Will flux alone do a thorough cleaning job on surfaces to be silver-brazed, or must a special process be used?

Answer:

Flux is compounded to remove a certain amount of metal oxides. It contains a wetting agent to help break up thin films of oil commonly encountered on mill-supplied materials.

When accumulations of dirt, grease, oil and oxides become excessive, however, they can retard wetting by both the flux and alloy. Consequently, it is often possible to predict if the brazing alloy is likely to wet by examining the way flux adheres to a surface.

To illustrate this point, laboratory technicians used a thoroughly oily steel plate which had been lying around a shop.

They cleaned and degreased one half of the plate; the other half was left intact. They then applied a standard flux to each half.

There was an even coating of flux on the cleaned half, and flux-less islands on the oily half. If brazing were attempted on a piece in the latter condition, the alloy would wet so sparsely that a mechanically weak and probably leaky joint could be expected.

If flux wets poorly, the wisest and most economical thing to do is to clean and degrease the pieces before attempting to braze them.

The usual cleaning procedure is this: degrease in a vapor degreaser or suitable solvent. Remove any oxide by pickling or by touching the piece to an abrasive belt or wheel.

When handling cleaned parts, do not touch the joint faces; a greasy finger print is as much of an offender as a patch of oil or oxide.

—Information courtesy of Handy & Harman.

* * *

Question:

What is the best way to clean molybdenum, tantalum and tungsten parts for electronic tubes.

Answer:

Every contaminant must be completely removed from the component parts for electronic tubes. The minutest particle of foreign material—even a fingerprint—can create trouble when the tube is purged with gas.

Although it is possible to use a saturated solution of potassium dichromate in hot concentrated sulphuric acid, chromium trioxide is preferred. The latter element completely eliminates any possibility of potassium residues in crevices.

A solution of hot chromic acid—of the type commonly used for cleaning glass—will clean the surface thoroughly and dissolve copper residues left by spot-welding electrodes.

Cleaning solutions for molybdenum or tungsten should be kept at 90 C, while for tantalum a temperature of 110 C would be correct. A red bath should be maintained, and muddy or green baths must be changed.

All traces of acid cleaner must be removed from the parts after the acid wash. Rinsing in hot, distilled running water is a preferable method, although dip rinses can be used where running water is not available.

Drying is best if done with dust-free warm air. Any handling during the drying process should be avoided, and no cloths should be used.

If parts are grit-blasted to provide a greater radiation surface, the acid wash should be applied after blasting is completed. No. 90 steel grit, applied for a few seconds at 20 to 40 lb pressure, is usually recommended for tube parts.

Iron particles should be completely removed by cleaning in hot hydrochloric acid. Only an abrasive of this type should be used. Sand, alumina and silicon carbide will become imbedded in the metal and any chemical treatment used to remove them will attack the metal.

It is important in grit-blasting to hold the nozzle at an angle to the tube part. This will create fine "whiskers" rather than indentations, and will thereby serve its primary purpose: increase the amount of surface. Naturally, grit should be both clean and sharp.

Hydrogen firing is often used to relieve cold strains, set dimensions, reduce oxides and chemically clean tube components. This process, however, is not a substitute for acid cleaning.

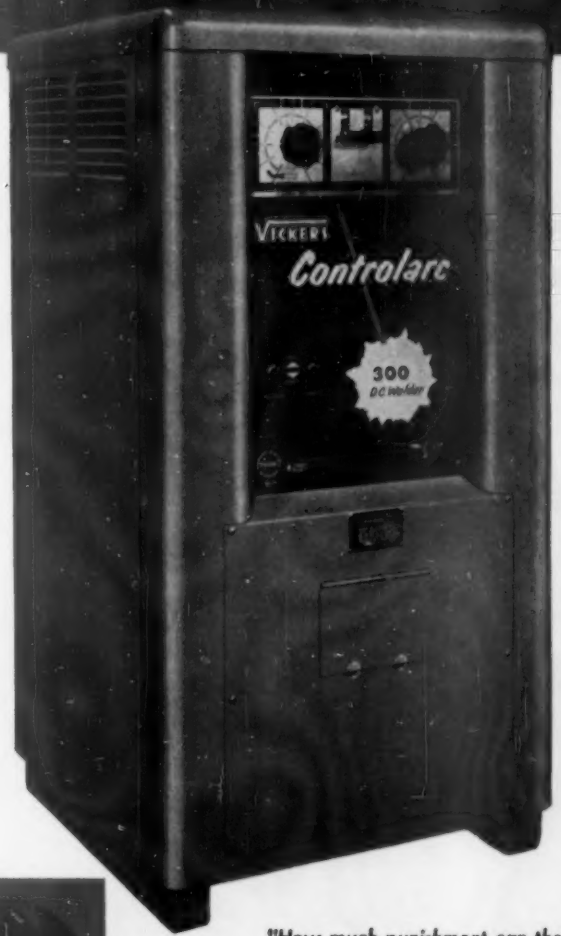
A temperature range of 800 to 1,000 C is used for molybdenum or tungsten, and the firing may take from 10 minutes to half an hour.

Hydrogen firing cannot be applied to tantalum parts, for hydrogen combines with tantalum at high temperatures to form a brittle hydride.

Always use pure, dry hydrogen gas for firing. If no further forming is to be done, cracked ammonia gas may be used. No free ammonia, however, can be present.

—Courtesy Fansteel Metallurgical Corp.

VICKERS® Controlarc DC Arc Welder Survives Punishing "Durability Test"



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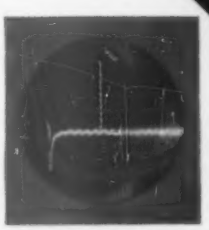

This unretouched oscilloscope photograph shows the voltage trace occurring when the arc was broken very quickly during the test, subjecting the CONTROLARC welder to severe abuse.

"How much punishment can the Vickers CONTROLARC DC Welder take?"

Vickers engineers decided to find out.

A 200-ampere CONTROLARC was subjected to a gruelling durability test. Every nine seconds the welder was charged with a six-second load of 250 amperes (50 amperes above rated capacity) at 27.5 volts. After 198,900 "makes" and "breaks" the load was boosted to 300 amperes at 27 volts. When the test was concluded the CONTROLARC had survived 1,004,522 of these charges, *and was still going strong*—with no apparent effect on any part of the welder. This test simulated arc tacking on production at 4 tacks continuously per minute on an 8-hour day basis for over two 300-day years.

For complete information about this rugged, dependable welder, write today for new bulletin.

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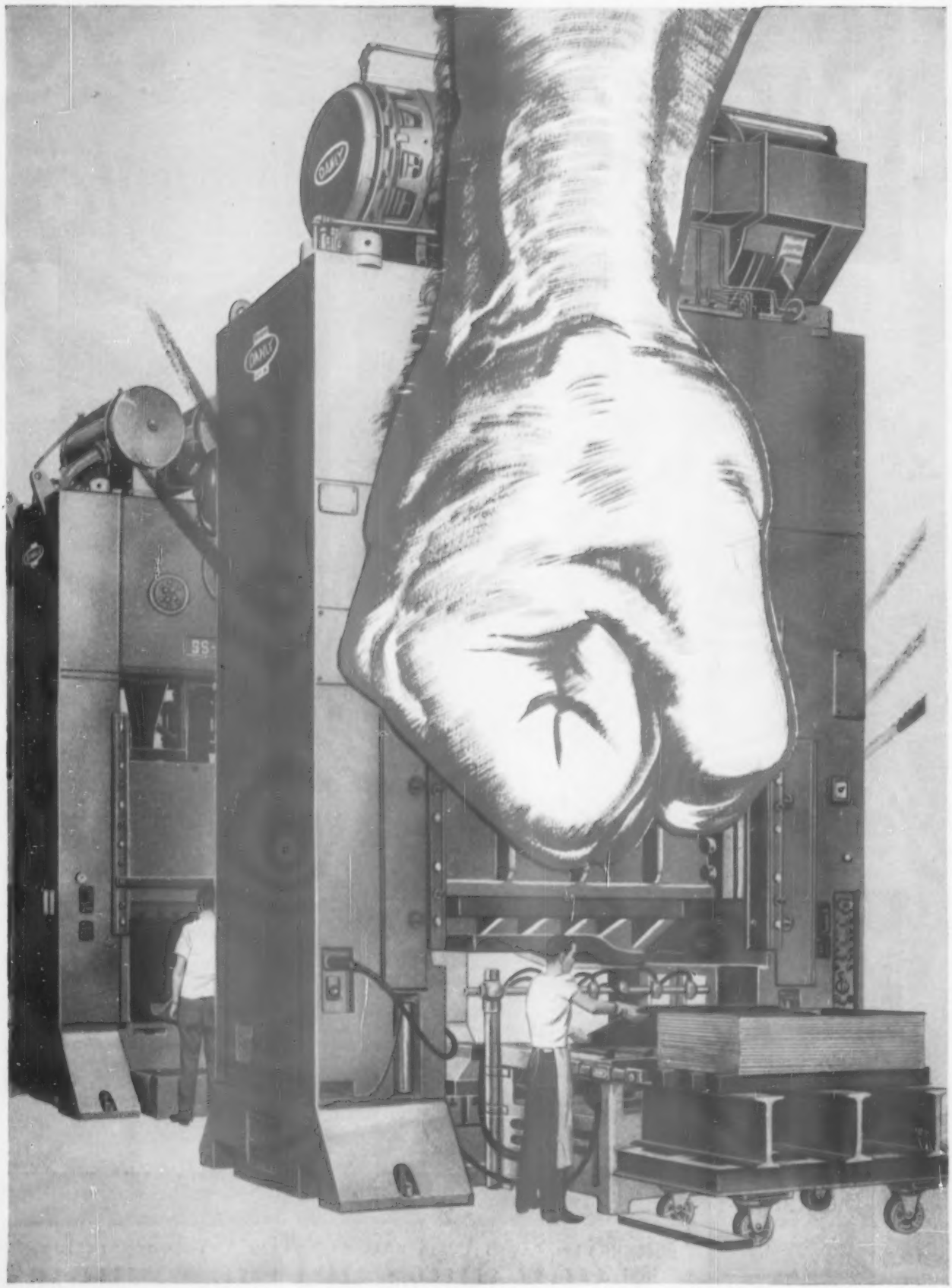

Here, welds have "guts" to withstand

400 tons of PUNCH

A. O. Smith electrodes are used to weld this 400-ton Danly press... a massive double-action unit that turns sheet steel into functional shapes

DANLY MACHINE SPECIALTIES, INC., know that high-production machinery requires bonus strength and stamina. The company's presses are used to produce everything from small appliance parts to automobile bodies. Output ranges up to 1,000,000 stampings per eight hour day.

Danly chooses A. O. Smith electrodes to make welds that stand up to toughest production needs. Consider, for example, the electrode used by Danly to build the 400-ton press pictured at left:

SW-35 (AWS-E-6020) for deep groove horizontal fillet and downhand mild steel welding. A "hot" mineral type electrode. You get remarkable speed and extreme ductility. Operation is quiet with fine spray and smooth arc. Produce 45° fillets without undercut . . . obtain consistently good x-ray quality. Yield point, as welded, is 56,600 psi . . . stress-relieved 48,900 psi.

Want more facts about A. O. Smith electrodes? See your man from A. O. Smith . . . or write A. O. Smith Corporation, Welding Products Division, Milwaukee 1, Wis., for a complete electrode catalog.

The man from A. O. Smith...

Owen Lundgreen is the representative who helped Danly select the right A. O. Smith electrode for press production. More than just a salesman — *a real welding consultant* —your man from A. O. Smith is exceptionally qualified to help you with your welding problems.

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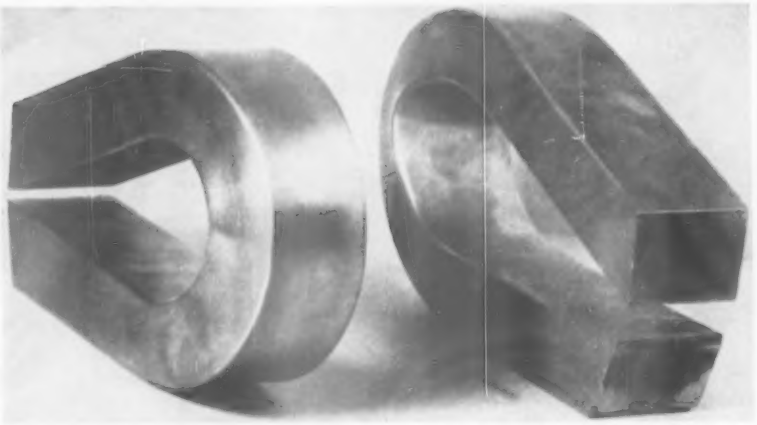
Better welds through improved inspection



—Photos courtesy Lincoln Electric Co.

FREE bend test specimen, which received machine compression at point of weld made by shielded arc method. Stretch in outer fibres of weld metal corresponds to an elongation of roughly 54%

BY FRED SPENCER

RAPID progress in the application of welding procedures as a method of fabrication has been largely a result of continual efforts to obtain quality consistency in welded joints. The increasing dependability of many welding processes is indicated by increased usage in critical industries.

In every welding shop, large or small, the establishment of standards for quality and subsequent maintenance of quality is of major importance.

Obviously, one important factor affecting quality of the welded joint is the actual design of welded structures, along with the effect of joint design on the welding technique to be employed.

The designer must have a thorough knowledge of such factors as weldability of materials; characteristics of various welding processes (inherent advantages and disadvantages); stresses that will develop in a welding process, and methods employed either to eliminate or minimize these residual stresses.

One common error, which is not confined to the welding field, is the placement of weld joints in almost inaccessible portions of a structure. Welding requires the utmost skill and dexterity of the operator, and even a skillful weldor will produce a poor quality joint if that joint is badly located.

Type, location and contour of the weld joint has a direct bearing not only on ease of welding, but also in the quality of the completed weld. Edge and corner joints usually are the easiest to make regardless of welding process used and, therefore, a high quality factor can be anticipated.

Design and Contour

Both weld joint design and contour of weld joint will also have an influence on the economics of welding (as exemplified in welding speed and electrode consumption).

In considering residual welding stresses in the design stage of a part, a thorough knowledge of welding metallurgy is required. However, it should be realized that in maintaining a high quality of weld, it is difficult to eliminate all residual stresses.

It is desirable to calculate residual stresses carefully and gain good equilibrium. Later application of external stresses during service should only unbalance this equilibrium, and not add further stresses which may threaten the yield point of the weld and result in ultimate part failure.

The use of relatively short beads is standard practice in minimizing residual stress.

In determining shop quality factors, prime consideration should be given to all personnel. In addition, consideration should also be given to methods employed in testing weld quality and in setting standards of quality. Test procedures and standards of quality will vary with each job and should be outlined in complete detail for efficient and intelligent use.

Weld Inspection

Depending upon rigidity of quality standards, and the quality factor of personnel, factors to be considered in weld inspection are:

(a) fit-up and alignment of parts; electrode and base metal analyses as stated in a specification or blueprint; and the matching of jobs with the abilities of individual weldors;

(b) the actual welding process, where the inspector will note such factors as the characteristics of the weld bead deposited in a fusion weld, the relative angle of electrode and joint, the slag-covering characteristics of the weld deposit, and the sound of the arc as the bead is deposited;

(c) post welding procedures, which include visual methods of inspection, inspection for structural discontinuities, and a check on the properties of weld metal by the use of established testing procedures.

To obtain adequacy of inspection, an inspector must have certain qualifications which permit him to operate efficiently. These qualifications may vary with the requirements of each specific job, but the following can be given as a guide:

(a) An inspector should have good eyesight and his physical condition should permit efficient work.

(b) He should be familiar with the code or specifications under which work is to be performed.

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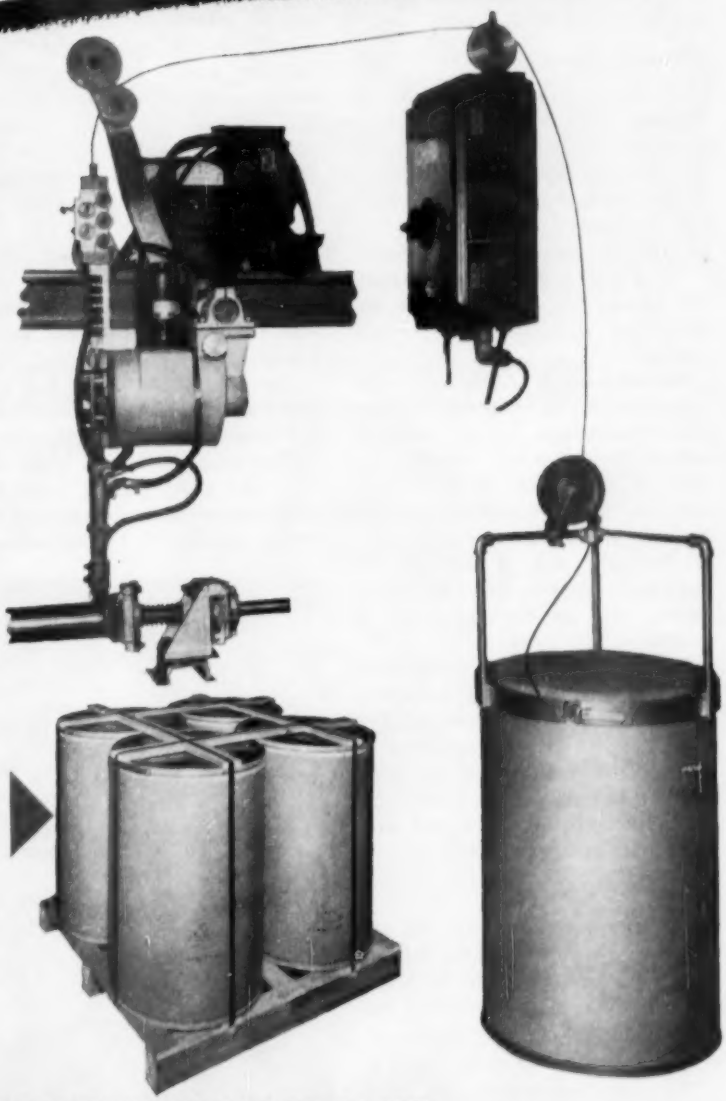

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(c) He should have sound judgment and the ability to obtain full co-operation from those he contacts in the performance of his duties.

(d) He should be familiar with electrode and base metal specifications, the interpretation of blueprints, the welding methods available, and with the interpretation of results obtained by standard test methods.

(e) He should know whether a satisfactory welding procedure is followed, be familiar with the "cause and effect" of common weld defects, and know the factors that will result in a good weld.

Staff Cooperation

An inspector is a high-calibre individual when he qualifies, but he is not a superman. By working with the company's technical staff, he will obtain needed assistance on welding production factors and advice in the interpretation of test results.

There are a number of accepted test procedures which can be employed in determining weld joint quality.

One of the most widely used methods of inspection is visual examination—examination by eye, with or without the aid of low magnification (10x or less). This method of inspection requires adequate light through use of an extension cord or flashlight and, if internal surfaces are to be examined, an optical device, such as the boroscope, is needed.

In the event of a dimensional check, standard tools of inspection such as gages and fixtures are employed. When visual examination is combined and correlated to other standard test procedures, a true evaluation of both weld joint and weld procedure will be realized.

Prior Examination

Visual examination may be employed in any phase of the welding cycle. When used prior to actual welding, some of these critical factors should be noted.

(a) cleanliness of weld joint;

(b) edge preparation of joint, dimensional accuracy of material to be welded, alignment and methods of maintaining alignment of joint, and the dimensional accuracy of the prepared weld joint;

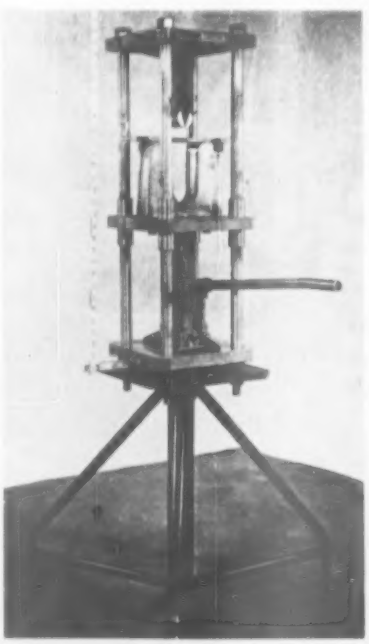
(c) determination of electrode and base material analyses to see that recommended types are employed, and a check of the weld piece for such defects as laminations, seams, and scabs.

Visual examination during actual welding is of particular value in a fusion welding process where the following factors should be observed: *(a)* type and polarity of current; *(b)* weld speed; *(c)* electrode consumption; *(d)* characteristics of the electrode and bead; *(e)* sound of the arc, and *(f)* characteristics of the crater.

In the event that multi-pass welding procedures are employed, additional factors to observe during welding would include: *(a)* slag coverage; *(b)* method and thoroughness in removal of slag; *(c)* examination of each weld layer deposit for bead defects, and *(d)* determination of electrode size, amperage and electrode position.

In a resistance welding process, the information obtained by visual observance is not as complete as that obtained in a fusion welding procedure.

There are, however, a few pertinent factors which can be checked: *(a)* dimensions of the weld joint, including proposed lap on seam welding; *(b)* spot spacing from both edges between spots on spot and projection welding; *(c)* examination of physical dimensions, contour and dressing of electrodes; *(d)* cleanliness of weld joint, and *(e)* current, electrode pressure and weld speed.



GUIDED bench machine, a severe test, definitely indicates soundness of a fusion weld

No quality check precludes sound judgment and well-planned procedures. Another factor of importance, regardless of test type used, is a true and honest evaluation of weld quality as indicated by these tests.

Test Selection

Depending upon the degree of quality desired, test procedures should be chosen carefully.

The tensile test is a destructive one in which a test bar is placed under a tensional force applied at constant rate until fracture occurs. Values of tensile strength, yield strength, reduction in area and elongation of the test bar are determined.

Yield strength and tensile strength will be indicative of strength properties of the material under test. Elongation and the reduction in area will be related to ductility of the material.

In a fusion welding process, a sample specimen can be made either from the base metal to be welded or a section in which the actual welded joint is included.

In a resistance welding procedure, the test specimen would include the welded joint. In both cases where the test specimen includes the welded joint, direction of the weld should be perpendicular to the direction of the tensive force, and in the center of the test specimen.

The guided bend test is quite simple in equipment needs and in operation. Although it is considered a severe test, it will definitely indicate the soundness of a fusion weld.

Nick-Break Test

The nick-break test also is indicative of weld soundness. The sample specimen, 1½ or 2 in. wide by 8 in. in length by plate thickness, is so placed that breakage will occur in the weld area.

The test specimen is nicked on both sides and, when struck with sufficient force, will fracture at the "nicks" and expose the metal for examination. Basically, this equipment is like the guided bend test machine, except that travel is shorter.

Impact tests may be conducted with various types of equipment—the most common being the Izod or the Charpy machines. These tests

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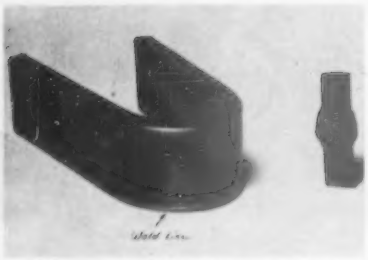


LEFT: a guided bend test specimen which has proven acceptable. Right: affect of accelerated corrosion (boiling in 50% muriatic acid) on base and weld metal. Piece is mild steel joined by shielded arc method

are similar in method to the nick-break test, but differ in that a definite value, expressed in terms of foot pounds, is obtained. A comparison between shielded arc and bare or lightly covered electrodes can thus be given.

Izod tests of weld metal deposited with a shielded arc electrode will have an impact value of 50 to 80 ft lb, whereas a deposited weld made with bare or lightly coated electrodes will have from 8 to 15 ft lb impact.

This test is often a guide in selecting material with low sensitivity to notch effect. Izod values are usually higher due to the greater cross section of test specimen (consult ASTM specification E23-47T).

Relatively simple and inexpensive, the free bend specimen test indicates both elongation and compression of metal in the welded joint.

Metallurgical Tests

Metallurgical tests include both macroscopic and microscopic examination of welds. Selected samples from the weld joint are polished and etched. For a macroscopic test, a deep etch will determine any gross imperfections within the weld or the heat-affected zone.

In microscopic examination of a welded area, a lightly etched polished surface is examined under high magnification (100x or more) to determine:

(a) distribution of non-metallic inclusions in the weld, the heat-affected zone and parent metal;

(b) grain size of the weld and heat-affected zone;

(c) structure type and, as in grain size determinations, affect of any heat treatment that may have been placed on the weld;

(d) whether there are any imperfections present in the weld area.

Chemical testing, basically, is associated with the determination of chemical constituents in either the base plate, electrode, or the weld itself. It may also include corrosion testing, a major specification factor, especially where stainless steel or similar corrosion-resistant material is welded.

Accurate Data

Where corrosion testing is performed on a controlled basis, accurate comparative date can be obtained. The results are measured, usually, in terms of weight loss per square inch of surface exposed, or in inches of penetration per month.

The non-destructive magnetic particle inspection test is quite sensitive in detecting surface discontinuities provided the surface is clean and relatively smooth. Value of this test is dependent upon the accuracy in interpretation of results by a trained operator.

It has been stated that, when properly used, this test accurately reveals defects such as cracks, incomplete penetration and inclusions to a depth of ¼ in. below the surface of the weld. These defects may be indicated as deep as ⅜ in., but with less precision.

This method is used on magnetic materials and requires costly equipment. Due to the specialized nature of this test method, equipment suppliers should be contacted for their advice on specific problems.

Also a non-destructive type, *the fluorescent penetrant inspection* is quite similar to the magnetic method in that it is sensitive in detecting surface flaws. The process, however, is designed for non-magnetic materials such as aluminum, magnesium and stainless steel weldments.

Black-Light Detection

This test method employs a penetrant containing a dye with fluorescent properties. Low surface tension of the penetrant enables it to be drawn into very small surface openings.

The penetrant is placed over the entire part, and after suitable preparatory steps the part is examined in a dark room under a black light. The penetrant in the surface openings will cause surface flaws to glow.

Radiographic tests are non-destructive procedures used quite frequently in the location of such internal discontinuities as blow-holes, inclusions, lack of penetration and cracks.

Equipment is initially high in cost and requires trained operators. Where the quantity of work is large, standards are often prepared to be used as a guide in interpreting results of the test.

The stethoscope has been used as a test procedure, but has gained little recognition as such due to variances in the interpretation of results. The work is tapped lightly with a hammer and irregularities are amplified by the stethoscope.

Supersonic testing, using a cathode ray oscilloscope, also has been used in determining the soundness of weld. Sound waves are passed through the material tested. Any discontinuity within the weld will partially deflect the sound wave, and this interruption of a pattern is noted on the oscilloscope screen.

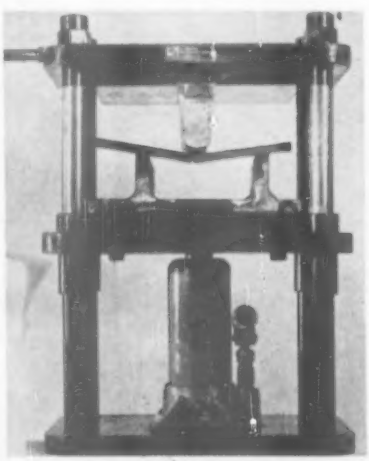
Obviously, there are any number of test procedures which can be used to determine weld quality. But tests differ, and so do people. So always be sure that the test you select will give you desired results, and that your inspectors and test interpreters are the best people for the job.

REFERENCES

Procedure Handbook of Arc Welding Design and Practice, 9th edition, 1950, The Lincoln Electric Co., Cleveland, Ohio

Welding Handbook, 3rd edition, American Welding Society

Resistance Welding Manual, Resistance Welder Manufacturers' Association

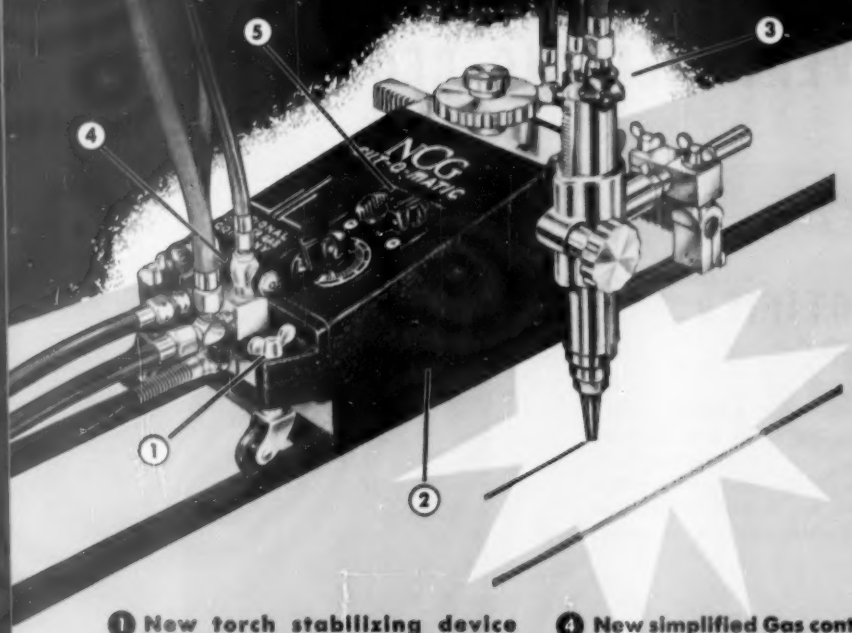


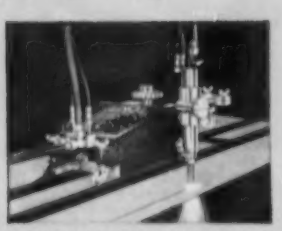
STRIKING a welded and nicked plate, this machine will fracture and expose the metal for examination

More Accurate, Lighter Weight

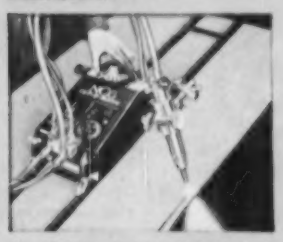
NEW CUT-O-MATIC® NO. 7

PORTABLE FLAME-CUTTING MACHINE

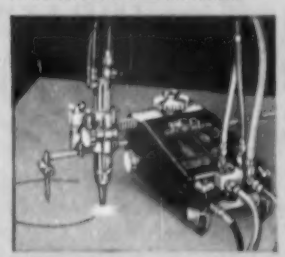




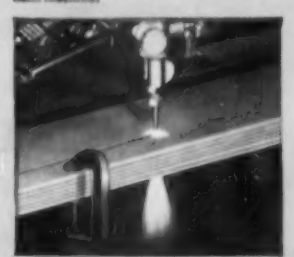
Straight Line Cutting—A 5-foot section of rigid track is supplied with each machine. By using two lengths progressively, a straight cut of unlimited length can be made in one continuous operation.



Bevel Cutting—Straight or circle cuts can be made to any bevel angle by a simple adjustment of the **Cut-O-Matic** torch holder.



Circle Cutting—True circles and arcs, 3 inches to 80 inches in diameter with either square or bevel edges, are cut easily by attaching the radius rod assembly furnished with each machine.



Stock Cutting—Where many pieces of the same dimensions are needed, stock-cutting with the **Cut-O-Matic No. 7** provides real production line economies. Simply clamp plates as shown and use larger size cutting tip.

1 New torch stabilizing device brings new cutting accuracy—A new, unique *floating rear caster* assembly practically eliminates machine wobble and side tilt, when passing over rough, unevenly surfaced plate. Gives production-line accuracy, clean, smooth edges, no finishing.

2 New design cuts 20 lbs. off weight—Almost unbelievably, this new improved CUT-O-MATIC now weighs less than 30 lbs., for ready portability, greater ease of handling—yet it's more rugged than you'll ever need.

3 New 3-hose torch now spells improved cutting efficiency—The new CUT-O-MATIC 3-hose torch has individual oxygen hose to both preheat and cutting orifice, simplifying preheat oxygen adjustment and assuring more efficient cuts.

4 New simplified Gas control—A new valve block assembly now locates preheat controls on machine, separated from high pressure oxygen control on the torch. Adjustments on preheat now made freely without disturbance to oxygen control.

5 New switch is maintenance-free for life of machine—New rotary-type switch, exclusive with NCG, provides trouble-free starting, stopping and reversing for life of machine. Has silver electrical contacts, is permanently sealed against grit and dirt.

CUT-O-MATIC has been redesigned throughout, offers many more advantages than those mentioned here. No other portable flame-cutting machine like CUT-O-MATIC. Get proof, the full story. Ask for a demonstration or write for new big broadside from any authorized NCG dealer or nearest NCG office or address below.

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MILLER SR RECTIFIER TYPE DC ARC WELDERS

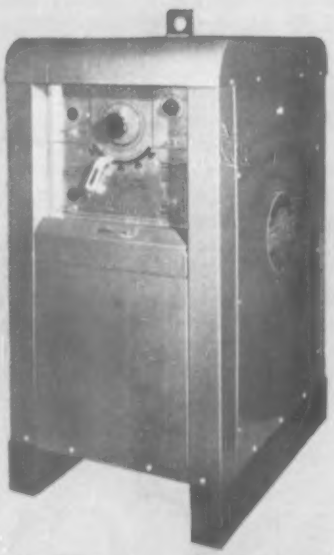
Available in 200, 300, 400 and 600 amperes, it is a superior direct current welder using Miller Unitran transformer control and selenium rectifiers for conversion from 3 phase AC line current. Miller SR Welders feature widest possible current range, extreme arc flexibility, maximum electrode deposition rate and highest electrical efficiency.

THE *New* MILLER SRH RECTIFIER TYPE DC ARC WELDER

A new concept in welder design for all DC metalic arc welding. Available in 200, 300 and 400 amperes. It is ruggedly constructed, compact, and is designed to lend itself to stacking for parallel operation or to conserve floor space. It has single range control and is weatherproof.

MILLER ARC WELDERS FOR TUNGSTEN ARC WELDING PROCESS

These Miller Welders feature the patented Miller UNITRAN control circuit which combines the transformer with its own integral flux diverter. This, in conjunction with adequate open circuit voltage, high frequency, balancing resistor and optional controls insures superior uniformity and flexibility throughout the entire welding range. Available in nine models.



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THE *New* MILLER MULTI ARC COMBINATION AC-DC WELDER

Available in 14 models, this new Miller Welder provides both AC and DC welding power for applications where both are required. It operates from a single phase power line and is available with high frequency and controls designed especially for inert gas arc and spot welding.

MILLER 100 SERIES HEAVY DUTY INDUSTRIAL TYPE AC WELDERS

Designed for heavy production welding and automatic welding applications. Available in eight models. The 100 Series Welders permit faster welding — as much as 35% faster. Movable coil design and 80 volts O.C.V. produces uniform and better welding characteristics throughout the entire range of the welder.

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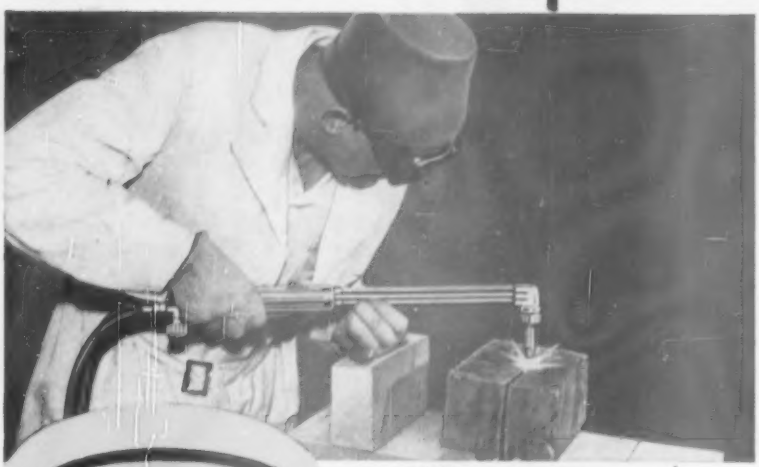
Light weight torch cuts 4" steel-*FAST*-at low pressures



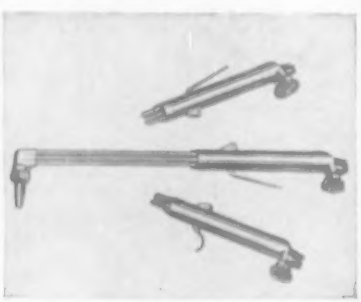
SMITH'S **Silver Star☆ CUTTING TORCH**

This is a light torch—only 2 lbs. 9 ozs. for the 20½" length. But, the way it cuts thick steel at low gas pressures is something to see. Eight pounds is all you need to cut up to ½" steel. For heavier cuts, pressures are proportionately low. Oxygen consumption reduced by 50% in some cases. That's real economy!

Another thing: You don't need a wrench with this torch! Tips slip into torch head, tighten with twist of fingers. That's a time saver! (Special Smith patent.) Lever Over Handle, Lever Under Handle, or Trigger—you have all 3 in this one torch to suit all operator requirements. Ask us for complete details on this sensational new cutting torch.

Only 8 lbs. gas pressure cuts ½" steel

Observers can't believe their eyes when they see this new Smith's Torch cutting ½" steel with only 8 lbs. oxygen pressure. Look at the gas you save! This torch costs less to operate.



Saves up to 50% oxygen

That saving counts up over a period of time! Even heavy cuts up to 10" take less gas than ordinary equipment. This torch is versatile and economical. "Burners" told us what they wanted and we built those features into this torch.

Full information on request — mail coupon

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LETTERS . . . . *from page 8*

formation from your magazine so that I may help others in this field.

Asa L. Gill
Denver, Colo.

* * *

Dear Sir:

Since reading the article, "Low-cost welded house" by John D. Bert in WELDING ENGINEER, we have become quite interested in building such a house. Would you please send me the address of Mr. Bert, and any other information you might have on this type of house?

Charles E. Gaddis
Gaddis Machine Works

—The writers have been advised to contact John D. Bert, author of "Low-cost welded house," WELDING ENGINEER, June, 1955. In addition, other tear sheets and similar data on welded houses have been forwarded to them. (Although we haven't kept any records, it looks like Mr. Bert's article has prompted more letters than any other in a long time.)

* * *

Kind words

Dear Sir:

I would like to take this opportunity to compliment you on the fine magazine that you publish. I enjoy it very much.

W. R. Sams
North Las Vegas, Nevada

* * *

We, too, were confused

Dear Sir:

In reading the October issue of WELDING ENGINEER, I note that you have quite an article on welding standards ("Standards for welding: complicated and confusing," pp. 35-40).

Apparently you have become so engrossed in your subject that you are either confused or else someone who gave you the information was confused. On page 37, you state that the "Heating, Piping and Air Conditioning Contractors National Association has formulated standard welding procedures for manual metal-arc. . . ."

In the next paragraph, you say that the "National Certified Pipe Welding Bureau is an affiliate of HPACC, and has as its purpose administration of weldor qualification tests. . . ."

This is wrong; the HPACC has never formulated standard welding procedures. The National Certified Pipe Welding Bureau was formed to do just that. It has formulated, tested

(Continued on page 62)

Westinghouse announces new welder line with exclusive "wide-amp" control

Westinghouse proudly introduces a complete, new line of welding machines featuring new RA (d-c) and TA (a-c) industrial lines and a complete, new series of utility welders including an a-c—d-c machine.

Wide-Amp Control with single range on industrial rated machines provides the widest usable current range in the industry . . . a single range . . . from a soft, quiet, low-intensity arc for thin sheet metal work to an arc current well above the rated capacity of the machine for heavy jobs.

Wide-Amp Control with single range enables you to use safely these high welding currents because of *exclusive* Westinghouse De-ion® circuit breaker which constantly guards the windings against excessive temperatures.

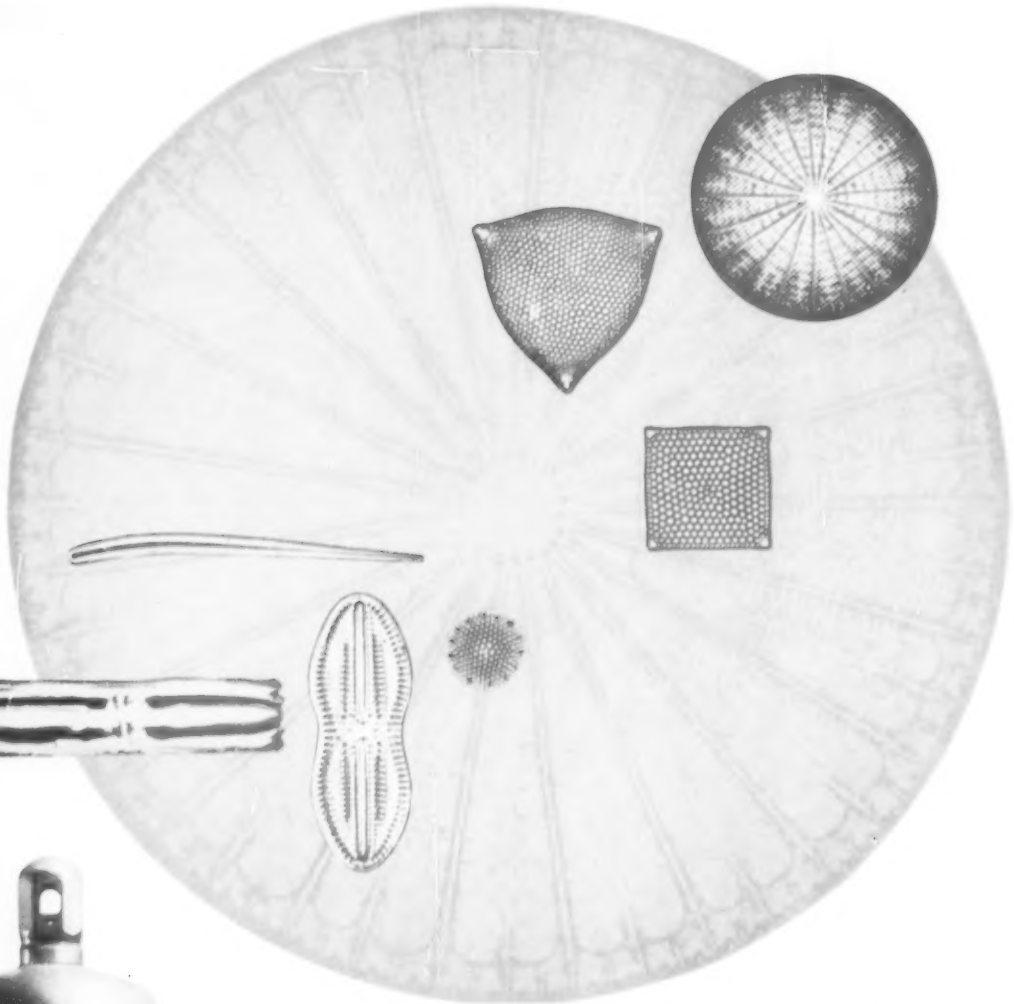
Wide-Amp Control also provides new and *exclusive* Westinghouse adjustable ARC DRIVE CONTROL on the d-c machines; arc drive control, in turn, gives a continuous additional surge of power where needed to prevent electrode sticking and arc snuffing. Convenient *polarity reversing switch* permits easy, fast changing.

Westinghouse, the pioneer in rectifier and industrial a-c welders, continues to lead the way. Order your new welder with *exclusive* single-range WIDE-AMP CONTROL from your Westinghouse distributor or nearest Westinghouse office.

Or write for free information to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21923

YOU CAN BE SURE...IF IT'S

Westinghouse



Diatoms from the deep for Acetylene Cylinders

Microscopic diatoms, by untold billions, compose the diatomaceous earth used as one of the four filler components in Norris-Thermador Acetylene Cylinders. Diatoms were living organisms, deposited on the ocean bed millions of years ago. Ages later, the waters receded, and today these deposits are employed in various fields of industry. Only specially selected diatomaceous earth is used in Norris-Thermador Cylinders to give the filler higher porosity and lightness. As a result, the filler takes gas faster and more uniformly, while the safety of the cylinder itself is materially increased.

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Have These Other Special Values

Check them: Cold-drawn construction . . . light-weight for easy handling . . . bases curled *under* for maximum strength and compact storage . . . larger cap holes—tags easily read without having to remove them . . . all welding x-ray controlled . . . specifications ICC 8 met and exceeded.

Acetylene cylinders from 10 to 300 cubic feet capacity.
Write or wire for specifications on all sizes. Cable: Northerm.

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5215 South Boyle Avenue, Los Angeles 58, California, Dept. WE-1255

3-1058

Recommended atmospheres for brazing

A. W. S. Brazing Atmosphere Type Number	Source	Maximum Dew Point °F, Incoming Gas	Approximate Composition				Application		Remarks
			%H_2	%N_2	%CO	%CO_2	Filler Metals	Base Metals	
1	Combusted fuel gas (low hydrogen)	Room temp.	.5–1	87	.5–1	11–12	BAg* BCuZn*, BCuP	Copper, brass*	
2	Combusted fuel gas (decarburizing)	Room temp.	14–15	70–71	9–10	5–6	BCu, BAg,* BCuZn*, BCuP	Copper†, brass*, low-carbon steel, nickel, monel, medium carbon steel§	Decarburizes
3	Combusted fuel gas, dried	−40	15–16	73–75	10–11		Same as 2	Same as 2 plus medium and high-carbon steels, monel, nickel alloys	
4	Combusted fuel gas, dried (carburizing)	−40	38–40	41–45	17–19		Same as 2	Same as 2 plus medium and high-carbon steels	Carburizes
5	Dissociated ammonia	−65	75	25			BAg* , BCuZn* BCu, BCuP BNiCr	Same as for 1, 2, 3, 4 plus alloys containing chromium‡	
6	Cylinder hydrogen	Room temp.	97–100				Same as 2	Same as 2	Decarburizes
7	Deoxygenated and dried hydrogen	−75	100				Same as 5	Same as 5 plus Co, Cr, W alloys and carbides‡	
8	Heated volatile materials	Inorganic vapors (i.e., zinc, cadmium, lithium, volatile fluorides)					BAg	Brasses	Special purpose. May be used in conjunction with 1 thru 7 to avoid use of flux
9	Purified inert gas	Inert gas (e.g. helium, argon, etc.					Same as 5	Same as 5 plus titanium, zirconium, hafnium	Special-purpose. Parts must be *very* clean and atmosphere must be pure
10	Vacuum pumping	Vacuum					Any metal which does not vaporize	Any metal which does not vaporize	Special purpose. Elaborate equipment and procedure

* Flux required in addition to atmosphere when alloys which contain volatile components are used.

† Copper should be fully deoxidized or oxygen-free.

‡ Flux must be used in addition to the atmosphere if appreciable quantities of aluminum, titanium, silicon, or beryllium are present.

§ Heating time should be kept a minimum to avoid objectionable decarburization.

Courtesy American Welding Society

ACCO products

3 Big Reasons for Buying PAGE Automatic Welding Wire

1. Packaged to fit your particular requirements

2. A wide range of analyses to fit a particular job

3. Greatest convenience — you can buy from local stocks

There is every reason why you should look to PAGE for your automatic welding wire needs. For PAGE not only manufactures wire in an extremely wide range of analyses, but packages them in a variety of ways for the most complete protection and convenience in handling and stocking. PAGE Distributors throughout the country carry stocks — this means savings for you, in ordering time and in inventory investment.

Shown above are some of the handy ways PAGE Automatic Welding Wire is packaged...There are lightweight, durable Leverpaks, which provide perfect protection against coil distortion or wire corrosion. They're easily opened and resealed, roll easily, stack perfectly and take a minimum of floor space.

There are single and pallet-mounted (1,000 lb., 2,000 lb., 3,000 lb.) coils, each wrapped in waterproofed paper and held secure by steel strapping; thread-wound, 25-pound reels to fit popular machines; also, coils in individual cardboard cartons, available singly or palletized for handling by fork-lift truck.

Page Offers 26 Analyses in Automatic Welding Wire

In order to provide you with *exactly* the correct automatic welding wire for your specific requirements—no matter how "special" or "different" they may be—PAGE offers no less than 26 different analyses from which to choose. These "cover the waterfront" of applications: heavy automatic submerged arc...light manual submerged arc ...inert gas manual and automatic, tungsten or metal arc.

Carbon Steel • Any carbon from Armco (.025 max.) to high carbon (.90—1.10). All standard AISI analyses in between.

Low Alloys • All the most popular welding grades

Stainless • AISI grade. Other types on request

Following is a list of the *26 analyses* in which PAGE Automatic Welding Wire is readily available:

Page A-S-Armco	Page A-S-110
Page A-S-6	Page A-S-15
Page A-S-10	Page A-S-15-MO
Page A-S-17	Page A-S-3½-Nickel
Page A-S-20	Page A-S-6150
Page A-S-65	Page A-S-4130

Page NAX-9115
Page-Allegheny A-S-Type 304
Page-Allegheny A-S-Type 308
Page-Allegheny A-S-Type 308 ELC
Page-Allegheny A-S-Type 309
Page-Allegheny A-S-Type 310
Page-Allegheny A-S-Type 316
Page-Allegheny A-S-Type 316 ELC
Page-Allegheny A-S-Type 347
Page-Allegheny A-S-Type 348
Page-Allegheny A-S-Type 410
Page-Allegheny A-S-Type 420
Page-Allegheny A-S-Type 430
Page-Allegheny A-S-Type 502

Details of all these analyses are contained in our new Folder DH-402. Write for it!

from Page's Wide Range You Can Get Exactly the Analysis You Need for Each Welding Job

• The *right* electrodes and the *right* rods for every welding job! That is what you must have for perfect operation—and that is what you can expect from the wide range offered by PAGE. Choose what you need from this complete line:

Gas Welding Rods

Armco Gas (GB-45)	Page Armco
Mild Steel (GA-50)	C Gas
Low Alloy (GA & GB-60)	Hi-Tensile M
3½% Nickel (GB-65)	3½% Nickel

.55—.65 Carbon	Medium Carbon
.90—1.10 Carbon	High Carbon
Manganese Bronze	Manganese Bronze
Naval Bronze	Naval Bronze
Stainless Steel	According to AWS analysis

Any Page A-S Automatic Grade in 36" Lengths

Bare Electrodes

Armco	Page Armco
Low Carbon	Page "CE"
.13—.18 Carbon	Page "B"
.55—.65 Carbon	Medium Carbon
.90—1.10 Carbon	High Carbon

Metal Spray Wire

Armco	Page Armco
.10 Carbon	#10
.28 Carbon	#25
.40 Carbon	#40
.60 Carbon	#60
.80 Carbon	#80
1.00 Carbon	#100
3½% Nickel	3½% Nickel
Manganese Bronze	Manganese Bronze
Naval Bronze	Naval Bronze
Stainless Steel Metal Spray	According to AWS Analysis

Convenient Service from Local Stocks

• Whenever you are in need of automatic welding wire, electrodes or welding rods, you can get them quickly and easily from your nearby PAGE Distributor—no matter what part of the country you live in.

PAGE Distributors carry ample stocks from which your requirements can be filled without delay or inconvenience to you. This handy service not only saves you time in getting what you need, but makes it unnecessary for you to make a sizeable investment in inventory. Thus, your nearby PAGE Distributor is able to make double savings for you—a saving in time and a saving in actual dollars.

Get the full Analysis List

All the 26 analyses of PAGE Automatic Welding Wire are set forth in complete detail in new **Folder DH-402.** A free copy of this informative folder will be sent to you on request. Write to our Monessen, Pa., office.

FREE

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Here is where you need the superior etched finish of Alcoa Aluminum Welding Rod

Cleaning alone cannot remove heavy oxides and other surface conditions customarily found on "as-drawn" wire surfaces.

Alcoa® Aluminum Welding Rod is *etched* to remove the entire outer layer of metal, leaving a surface that provides maximum rod "wetting" and freedom and control of weld flow.

This fine welding rod is now available in new, moistureproof, dustproof, resealable 5-lb tubes containing 36″ straight lengths in all standard welding alloys and diameters. Buy it from the distributors listed at the right.

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1740-M Alcoa Bldg., Pittsburgh 19, Pa.

Please send without obligation new, free 176-page book, *Welding Alcoa Aluminum*. Covers every phase of welding in detail.

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Your Guide to the Best in Aluminum Value

FOR IMMEDIATE DELIVERY, call one of the Alcoa distributors listed below. He carries a complete range of alloys and sizes o Alcoa Etched Finished Welding and Braz ing Rod, I. G. Consumable Electrode Brazing Metal, Solder and Flux.

For technical assistance, contact th nearest Alcoa sales office, listed under "Aluminum" in the yellow pages of your phone book.

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Birmingham
Hinkle Supply Co.
ARIZONA
Phoenix
Ducommun Metals & Supply Co.
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Metal Goods Corp.
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Milford
Edgcomb Steel of New England, Inc.
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Jacksonville
Florida Metals, Inc.
Miami
Florida Metals, Inc.
Tampa
Florida Metals, Inc.
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Atlanta
J. M. Tull Metal & Supply Co., Inc.
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Boise
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Chicago
Central Steel & Wire Company
Coray Steel Co.
Steel Sales Corp.
INDIANA
Indianapolis
Steel Sales Co. of Indiana, Inc.
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Marsh Steel Corp.
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MARYLAND
Baltimore
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Boston
Austin-Hastings Co.
Cambridge
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MISSOURI
Kansas City, North
Marsh Steel Corp.
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NEW HAMPSHIRE
Nashua
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NEW JERSEY
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NEW YORK
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Buffalo
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WASHINGTON
Seattle
Pacific Metal Co.
WASHINGTON, D. C.
Southern Oxygen Co.
WISCONSIN
Milwaukee
Central Steel & Wire Company
Steel Sales Co. of Wisconsin

Safety Congress asks:

Be your brother's keeper

By a Staff Member

FIVE of Chicago's largest hotels played host to a national and international group of exhibitors, speakers and guests as the National Safety Congress conducted its 43rd exposition from October 17 to 21.

Meaningful theme of the five-day session was: *"Be your brother's keeper . . . stop accidents!"*

A crowd conservatively estimated at 12,000 listened attentively as this theme was developed by over 800 speakers, representing practically every U. S. industry and occupation.

Over 190 firms maintained 256 colorful and interesting booths in all five hotels (the Conrad Hilton, Blackstone, Congress, LaSalle and Morrison hotels) to display the latest in safety devices and methods.

Modern Welding Problems

Although welding safety practices were touched on briefly by several speakers—principally as they are applied in construction and heavy machinery fabrications—only one paper was *directly* concerned with welding.

"Modern problems in welding" was the topic chosen by Edward A. Schneider, Plant Manager of Locke Steel Chain Co. of Bridgeport, Conn. Speaking at the Conrad Hilton hotel, Mr. Schneider emphasized the need for practical *safe thinking* in the choice and application of various welding processes.

OLD welding helmet (center) contrasts big safety strides taken by this manufacturer.

ONE of several displays by manufacturers of welding safety equipment.

Mr. Schneider pointed out that "the problems we have today are the same problems we found in the first welding application; . . . we call them modern because they reappear in each new welding application."

A choice in processes in which the weldor favors the one more familiar to him was cited by Mr. Schneider as one of many instances where resultant work may be inferior.

He cited a hypothetical firm which decided to substitute a resistance welding process for its present method of joining a high-volume product.

Safety Factors

All of the safety factors which had to be observed in making this installation were enumerated by the speaker: the redesign of parts, operator protection, proper exhaust systems, parts preparation and proper and adequate power sources.

A matter of timing was probably the principal reason why safety precautions taken by the welding industry were not more fully delineated from speaker's platform.

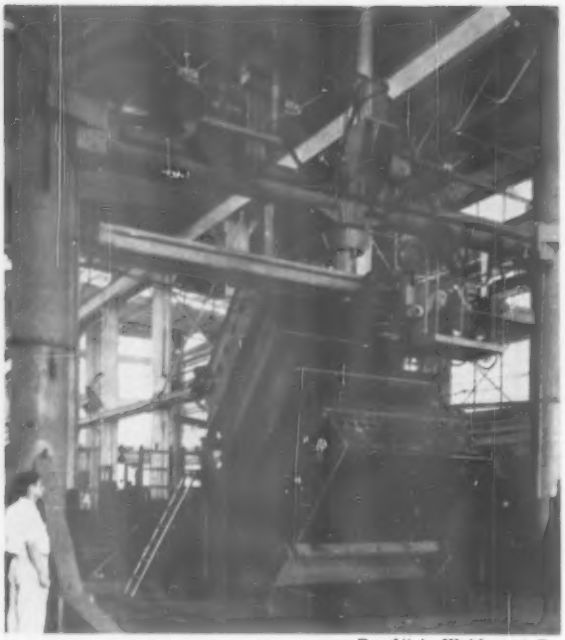
The annual AWS fall meeting was being held in Philadelphia concurrent with the Safety Congress in Chicago.

In future years, perhaps, a more fortunate convention schedule will allow welding representatives to point up their accomplishments and objectives at this finest of all safety exhibitions.

on the job . . .

—Linde Air Products Co.

MIG (metal inert-gas) welds are used by Warner Lewis Co., Tulsa, Okla., to fabricate a complete line of petroleum filters used on pipe lines, fuel trucks and tankers. Application here is on 3/16-in. aluminum bronze. Flanges are ¾-in. thick. Filters are also fabricated from carbon steel and aluminum, welded by submerged-arc process.



—Pandjiris Weldment Co.

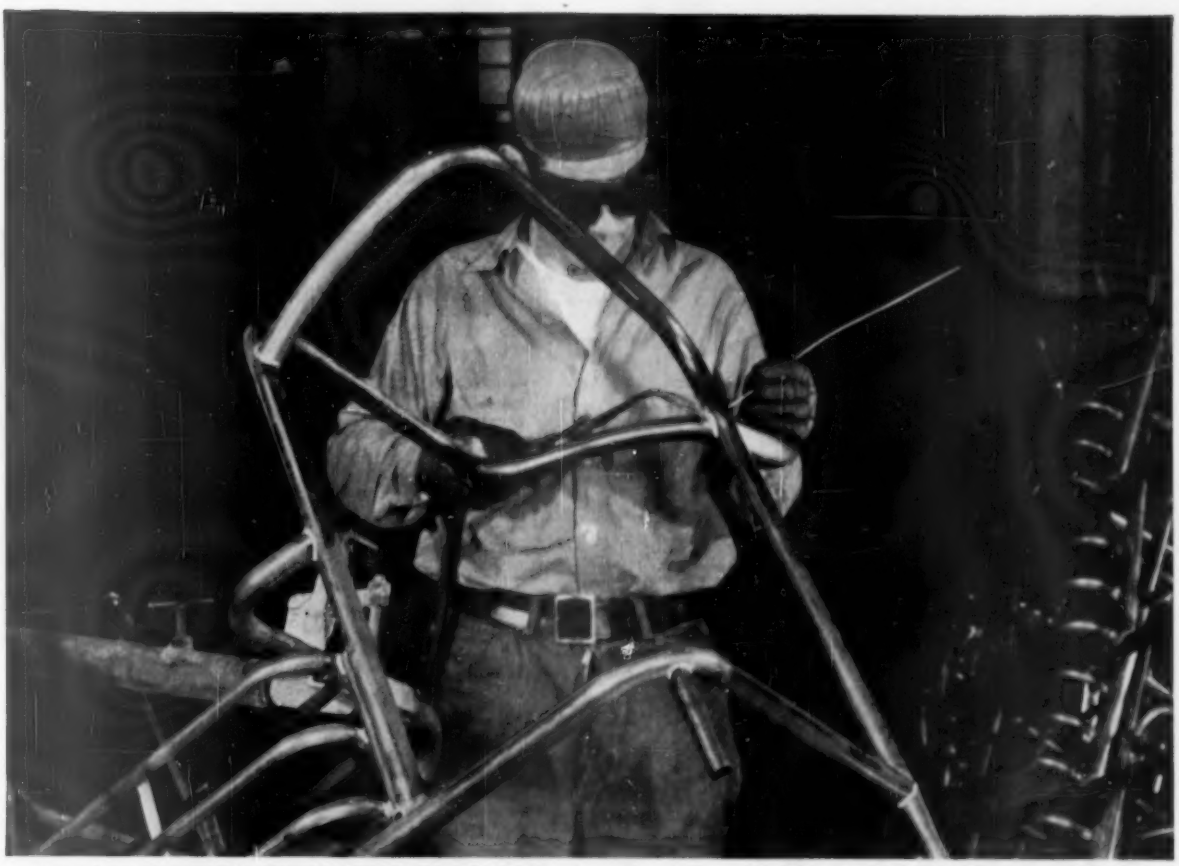
SELF-propelled gantry welder built for Wagner Electric Co., St. Louis, Mo. Gantry welds seams, top rings, brace bars and braces in fabrication of transformer tanks. Controlled by one man who travels with welding head, machine can lay 20-ft uninterrupted weld in any segment of a 20-ft-diameter circle without gantry movement.

—Baldwin-Lima-Hamilton Corp.

FORGED steel tire is arc-welded to cone section of a 6½-cu yd truck mixer drum at Blaw-Knox Co. Drum rotates on tire when truck mixer unit is in operation on way to job site.

—Kaiser Aluminum Corp.

LEFT: Aluminum skin is welded to one leg of a giant rocket (shown completed and installed above) which is now an integral part of the TWA Moonride exhibit in the Disneyland display in Anaheim, Calif.



A revolving fixture holds this tubular steel chair-desk while the weldor brazes the joints with ANACONDA-997 (Low Fuming) Bronze Welding Rod. Heywood-Wakefield Company began producing welded steel tubing back in 1910. Today, they are leading manufacturers of tubular steel schoolroom furniture, bus, subway, railway car and theater seating.

here's production speed . . .

23 braze welds in 17 minutes

Here's the finished chair with seat, back rest and desk sections in place.

They know a lot about the techniques of production welding at Heywood-Wakefield Company, Gardner, Mass. Take the combination school chair-desk you see here. First it's tack-welded by semi-automatic resistance welding. Then it goes into a revolving fixture for braze welding with ANACONDA-997 (Low Fuming) Bronze Welding Rod and the flame-fluxed oxyacetylene process. The weldor swings the assembly to reach all joints from one position, completing the 23 welds in an average time of 17 minutes.

It's not only a fast job . . . it's a *good* job. The credit goes to Heywood-Wakefield engineers for their time-saving fixtures; to the weldor for his skill, and to the ANACONDA-997 rods he uses. Heywood-Wakefield prefers these rods because the finished welds are very strong, and they don't require special cleaning before painting. They're degreased, wire brushed . . . then painted. That's all.

ANACONDA-997 (Low Fuming) Bronze is a superior welding rod used to join copper alloys, cast iron, malleable iron and steel by the oxyacetylene process. It is also used for repair welding, and to deposit bearing surfaces on steel and iron. You can get other ANACONDA Copper Alloy Welding Rods for many different repair and production welding purposes. They're sold by distributors of welding equipment everywhere. Anaconda distributors are also a good source of practical advice on welding problems. Pratt & Inman Company, Worcester, Mass., general distributors, furnish Heywood-Wakefield Company with ANACONDA-997 Welding Rods. For more information about ANACONDA Welding Rods and recommended welding procedures, write for a copy of Publication B-13. Address *The American Brass Company, Waterbury 20, Conn.* In Canada: *Anaconda American Brass Ltd., New Toronto, Ontario.* 55123

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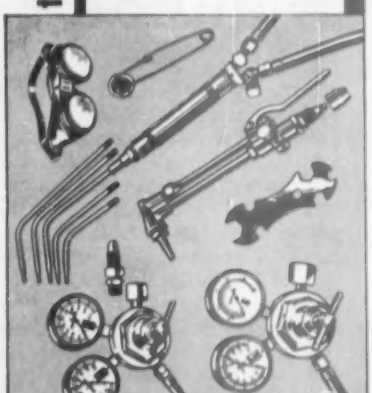

FOR EXAMPLE—The Dockson No. 145 Outfit illustrated above is for light and medium welding and cutting jobs up to and including 5' steel. At one low price you get—

1—No. 44-C Hi-Speed Welding Torch ● 1—Set, Nos. 2, 4, 6, 8 and 10 "T" Style Elbow Tips ● 1—C-4 Hi-Speed Cutting Attachment ● 1—C-2 Cutting Tip ● 1—No. 134-HC Oxygen Regulator, 200 lb. and 3000 lb. gauges ● 1—No. 134-AD Acetylene Regulator, 50 lb. and 500 lb. gauges ● 1—Connector to P.O.L. Adapter ● 1—12½ ft. length ¼" Siamese Hose ● 4—Hose Connections ● 1—Double Wrench ● 1—Round File ● 1—Flint Lighter ● 1—Ft. Series 44-19-A Welding Goggles.

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Dockson CORPORATION
2839 WABASH • DETROIT 8, MICH.

Splice welds save space, steel, money!

BY W. T. HAYES
and M. F. YALE*

DURING construction of the 165-bed Peninsula Hospital, in Burlingame, Calif., at least $18,200 and 70 tons of scarce reinforcing steel was saved by welding the column bars.

If tied splices had been used, 5,221 tons of reinforcing column bars would have been required. However, by using welded splices on column bars, which average 1-¼ in. in diameter, the contractors were able to make their big saving.

On this job, 7,100 splices had to be made. Approximately 21 lb of steel were used per splice. Since the steel cost about $0.08 a pound, this amounted to a saving of $1.68 per splice.

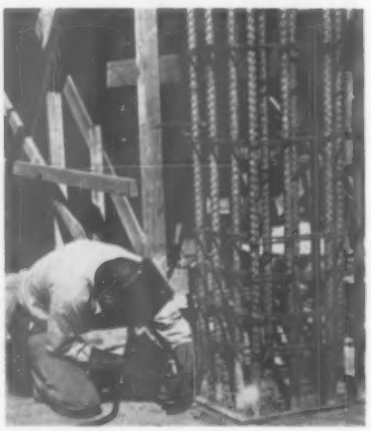
The welded splice was more time consuming than the tied splice, but the added labor cost did not bite very deeply into the $1.68 saving. An E6012 electrode was used throughout, and power was supplied by 250-amp engine-driven portable welders.

Besides saving approximately 25% in reinforcing steel, an additional saving of at least $7,000 was brought about because welded splices resulted in a reduction of floor area.

Space Saving

In general, column sizes were 2 in. less than would have been necessary if lapped splices had been used. Lower story columns had the maximum amount of steel permissible in order to keep concrete sizes to a minimum.

This reduction in corridor column sizes resulted in a direct reduction of the basic transverse spacing of corridor columns throughout the job. In some cases, reduction in column size saved floor areas in bays adjacent to corridors.



WELDOR completes circumference weld on column bar using E6012 electrode.

It is estimated that the reduction in column size due to welded splices resulted in a floor area reduction, in the corridors alone, of approximately 470 sq ft.

Construction Joints

Design requirements of this project located exterior wall construction joints at the sill and headlines of window openings. No construction joint was allowed at the floor line.

This located extreme wall column construction joints approximately 3 ft above the floor line. If lapped splices had been used, it would have been necessary to set and shore column cages above any floor being poured.

The engineers felt it was far better to make butt-welded column bar splices at the top of the wall pours some three feet above floor lines. This made it unnecessary to erect column cages a story in advance of the pours.

The welded column splices offered less interference to the passage of the upper spandrel reinforcement, which was often quite heavy.

A final important feature and advantage of welded column bars was in the reduction of main column reinforcement bending in the transition zones where columns changed size at different floor levels.

*Mr. Hayes is a member of the structural engineering firm which erected the hospital. Mr. Yale is a welding engineer with The Lincoln Electric Co.

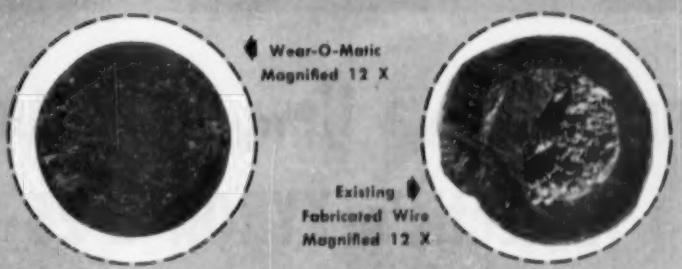
NEW...

Wear O Matic

Precision drawn fabricated wire for Automatic and Semi-Automatic Hard-Facing Applications

COMPARE

this major development in fabricated wire with existing wire . . .



These cross sectional views of fabricated wire were made under identical conditions. Notice the compactness and perfect roundness of Wear-O-Matic precision drawn wire as compared to existing fabricated wire. This dense, controlled diameter wire provides the smooth feeding and excellent arc characteristics of solid welding wire and insures a weld deposit that is uniform in soundness, chemistry and hardness.

Wear-O-Matic OFFERS THESE EXCLUSIVE FEATURES

1. Smooth, trouble-free feed with any automatic head—without special feed rolls or contact tubes.
2. Precision drawn for perfect roundness to insure continuous, smooth feeding.
3. Uniform compactness for uniform chemistry and hardness.
4. Electroplated with copper to prevent surface rust and insure positive electrical contact.

Make your own comparison . . .

Write for free sample specimen of new Wear-O-Matic wire—the only fabricated wire that's as easy to use as solid wire. Compare and prove to yourself why Wear-O-Matic is the wire you want now! Just write:

DRAWALLOY CORPORATION
Lincoln Highway at Alloy Street
York 12, Pennsylvania

Drawalloy

CORPORATION

YORK, PENNSYLVANIA

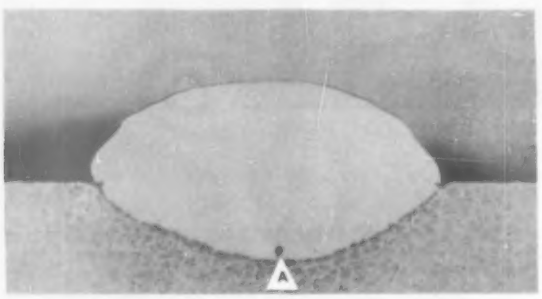
$3800 SAVED! When a transmission housing broke on a Boston U. S. Naval Yard railway crane, operations were suspended. The replacement cost of $3800 and a 6-month delay were saved with the Xyron 2-25 weldment illustrated. Careful tests proved the weld was completely free of cross checks and porosity.

Xyron 2-25 has been proven ideal for "cold" repair of large sections such as cracked motor blocks, machine bases, motor and gear housings. Xyron 2-25 makes it possible for the weldor to lay in large volumes of filler metal, run long beads without excessive heat build-up in the base metal. All the advantages of Eutectic's "Low Heat Input" welding process has been brought to the arc welding of cast iron.

$20,000 SAVED! When this $20,000 cast iron condenser crashed to the ground, the manufacturer expected to replace it completely or at best to stand an expensive and lengthy repair job. But, with Xyron 2-25 the entire repair was successfully completed in less than 100 hours. The repair was found to be entirely free of cracks and "leakers" and was accomplished without warping or embrittlement of the base metal. The weldors performing this job reported amazement with the faster, **non-stop** welding possible with this new Eutectic electrode.

Announcing a New, Revolutionary, crack-free Eutectic's XYRON 2-25 outperforms any

This photomacrograph reveals one of the secrets of Xyron 2-25's superiority over the usual nickel electrodes. Notice the shallow uniform penetration. The smooth tapered shoulders of this deposit minimize stress formations and aid slag removal, eliminate cracks and "leakers." The extreme fluidity and wetting action of Xyron 2-25 eliminates the need for a lot of electrode manipulation.



This photomacrograph of conventional nickel electrode deposit shows how built-in stresses are caused, resulting in dangerous cracking in service. This electrode gives only a deep, localized penetration with excessive build-up and lack of wash. This deposit is not even machinable at point A. Xyron 2-25 deposits are superior in machinability at every point.

WANT MORE PROOF?

Your local Eutectic District Engineer is ready to show you, in your own shop, with your own materials, that Xyron 2-25 will out-perform any nickel cast iron electrode you may now be using. He'll show you how Xyron 2-25 will let you make better welds at amazing savings in time and labor. Contact your local Eutectic District Engineer today or use the coupon to arrange an appointment.

Comparative Welding Characteristics of Cast Iron Rods and Electrodes

EUTECTIC new 1955 DEVELOPMENT

CHARACTERISTICS | DEPOSITION | PREPARATION

FEATURES	FILLER METAL COMPOSITION: ELECTRIC ARC: Xyron 2-25	ELECTRIC ARC: Nickel	ELECTRIC ARC: Nickel-Iron	ELECTRIC ARC: Nickel-Copper	OXY-ACETYLENE: Cast Iron	OXY-ACETYLENE: "Bronze"	REMARKS
VERSATILITY (Base Metal Variations)	Superior (1)	Excellent (2)	Excellent (2)	Limited (3)	Excellent	Excellent	1. Suitable for all types, including alloys. Meehanite, Ni-Resist, etc. 2. Alloying elements (or high phosphorus content) may cause cracking or poor weld. 3. More acceptable to checking due to composition variations.
ACTIVITY (Pre-cleaning)	Superior (1)	Excellent	Excellent	Good	Superior	Varied (2)	1. Ability to wet dirty and oxidized surfaces without pre-cleaning. 2. Surface must be chipped or sand-blasted. Improper cleaning or technique results in unbonded areas.
PRE-HEATING	No (1)	200 F	200 F	200 F	1500 F-2000 F	1300 F-1500 F	1. Usually not used except when maximum machinability is required.
ALL POSITION WORK	Excellent	Superior	Good	Excellent	Poor (1)	Good	1. Requires skill and experience to a great extent.
CRACK SENSITIVITY	Superior	Good	Excellent	Poor (1)	Superior (2)	Superior	1. Subject to cross-checking due to hot shortness. 2. Assuming cooling rate is uniform. Subject to hot cracking when exposed to draft or cool air currents.
LEAK PROOFNESS	Superior	Fair	Fair	Poor	Poor	Poor	
SLAG (FLUX) REMOVAL	Superior	Excellent	Excellent	Good	Very difficult (1)	Difficult (1)	1. Generally requires time-consuming mechanical action or special equipment (sand or shot blasting, etc.).
DEPOSIT APPEARANCE	Superior	Excellent	Good	Good (1)	Varied (2)	Varied (2)	1. Generally produces deposits of uneven surface (mottled). 2. Entirely dependent on individual skill.
COLOR MATCH	Excellent	Fair	Excellent	Fair (1)	Superior	Poor	1. Subject to copper segregation.
TENSILE STRENGTH (JOINT)	Superior	Excellent	Excellent	Good	Varied (1)	Varied (1)	1. Varies with joint design and amount of reinforcement padding.
HEAT RESISTANCE	Excellent	Excellent	Excellent	Fair (1)	Superior	Poor	1. Subject to hot shortness and segregation.
MACHINABILITY	Excellent	Superior	Good	Excellent	Superior (1)	Superior	1. Cooling rate must be retarded to prevent the formation of hard spots.

strontium-aluminum bearing electrode ... conventional nickel electrode for cast iron

perfect for all types of gray and ductile cast iron including "Meehanite", "Ni-Resist" and joining cast iron to steel

Here's proof of the superiority of Eutectic's new Xyron 2-25. Just study the comparison chart above and you'll see that Xyron 2-25 gives you everything you want for faster, better welding. The case histories shown are typical of the reports by users all over the country, in extensive tests.

And, Xyron 2-25 is not just another conventional nickel alloy electrode. Its new strontium-aluminum formulation gives Xyron 2-25 higher weld quality and strength by purging the molten filler metal from harmful sulfur and sulphides, purifying it from oxide inclusions and improving the electrode's fluidity. All types of cast iron alloys such as Meehanite, Ni-Resist, and others, cast iron joined to steel, even old, dirty, and oxidized surfaces can be welded without preheating when you use Xyron 2-25. Not only does Xyron 2-25 save you time, but it also minimizes or eliminates the danger of warping, stress or embrittlement of the base metals.

The crack-free feature of this new electrode makes it ideal for the newest metals in the cast iron field. There is no weldable application for cast iron for which Xyron 2-25 cannot be recommended. It is the electrode every weldor has been waiting for.

ORIGINAL Low Temperature EUTECTIC WELDING ALLOYS

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LETTERS . . . . *from page 48*

and qualified 12 welding procedures.

Inasmuch as the Bureau is an affiliate of HPACC, it has made these tested and qualified procedures available to all members of HPACC for the simple reason that HPACC has contributed financially to help pay the large expense of doing this work.

I do not write this to be critical of you or anyone else, but merely to keep the records straight.

Wray M. Scott, Chairman
National Certified Pipe
Welding Bureau

* * *

Dear Sir:

In reading the article on welding standards, by Ray A. Mueller, I noted two references to the AISC Specification which I feel should be clarified.

On page 39, the author states that the AISC published the "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings by Arc and Gas Welding." This was a tentative specification published in January, 1942, and was incorporated in the "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings (Riveted, Bolted and Arc-Welded Construction)" in 1946.

This current specification refers to the "Code of Arc and Gas Welding in Building Construction" of the American Welding Society, where applicable, and thereby does not impose additional confusing regulations.

In Figure II, page 36, the AISC specification is shown applicable to pressure vessels and boilers, buildings and bridges. This specification applies to buildings and is not intended to be used for the design of bridges, pressure vessels or boilers.

Edward R. Estes, Jr.
American Institute of Steel
Construction, Inc.

* * *

Brazing

Dear Sir:

I was interested in your Clinic, "Some facts about high-temperature brazing," in the May, 1955, WELDING ENGINEER. I might mention that the title is somewhat misleading as it leads one to believe that the brazing takes place at a very high temperature, while, in fact, the subject should be brazing for high-temperature service.

The brazing alloy used in this category can be had with brazing temperatures anywhere from 1,800 F on up to 2,150 F, on the normal series of

"140" Monel electrodes stop corrosion, erosion, and cavitation in 68,000-lb. cast-steel valve. The fabricator — Willamette Iron and Steel Company, Portland, Oregon — deposits weld metal on seating surfaces of the valve body (shown here) and plug. Then they machine the Monel deposit to form the final seating surfaces of the valve body and plug.

450 lb. Monel overlay protects 68,000 lb. steel valve from corrosion

Take it from Willamette —

Overlaying with "140"® Monel® nickel-copper alloy Electrodes is a practical way to get corrosion resistance when a part is too big to warrant making it entirely of this alloy.

Take this 68,000-lb. cast steel valve for handling drinking water. Just 450 lbs. of Monel overlay protect its vital areas from corrosion, erosion and cavitation.

Overlays like this are practical because it is easy to get strong, ductile, non-porous deposits with "140" Monel Electrodes. And the special low-carbon flux coating permits crack-free overlays directly on steel.

Do you have a similar problem? A part too big to make of solid corrosion-resisting metal, or a part with only one surface exposed to corrosives? "140" Monel Electrodes may be the economical way for you to obtain superior corrosion resistance.

Nickel and Inconel® overlays

When you want the advantages of a nickel overlay on steel, use Inco's "141"® Nickel Electrodes. And for resistance to high temperatures and corrosion, use "142"® Nickel-Chromium Electrodes.

For more information about the "140" series of electrodes, write Inco for Technical Bulletin T-2. It's a helpful, 44-page guide to "Fusion Welding of Nickel and High Nickel Alloys." A copy is yours for the asking.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

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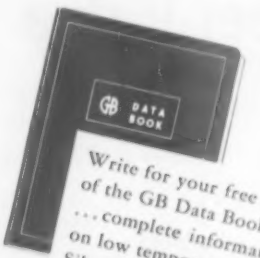
Speed • Efficiency • Economy

...GB Silver Brazing Alloys meet all standard specifications. Available in random coils, strip, preformed rings and special shapes. This is your answer to sound, leak-proof joints on virtually any ferrous or non-ferrous metal. Silver Brazing Alloys are easy to use in production, save time, labor and assure dependable results.

GB 88 Flux, an aid in silver brazing operations, a time-tested product, assures you of maximum protection and high quality joints. Team up a GB Alloy and Flux for dependable results. Other GB Fluxes available for specialized application.



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Address_____ City_____ State_____

chrome-nickel-boron alloys. Some variations, similar to the L. M. Nicrobraz, will melt and flow readily at 1,800 F having a solidus to 1,750 F.

The 1,800 F brazing temperature and temperatures up to 1,900 F are used in brazing copper containing alloys and stainless clad copper alloys. Likewise, the standard Nicrobraz, that melts also at 1,750 F, has a brazing temperature in the range of 1,950 F to 2,150 F although the brazing is usually carried out at ranges of 2,150 F to accomplish the solution treatment mentioned in the article.

While there are many applications where these alloys have been put into jet engines at the present time, the quantity of this type of work being done is small, and the quantity of brazing alloy being used, even after five years of work on this program, is still exceedingly small.

R. L. Peaslee
Wall Colmonoy Corp.

* * *

Regulations don't create!

Dear Sir:

With predictions and indications pointing to an all-time high production in the metalworking industry, it is timely, and extremely interesting, to read your editorial approach to the long overdue clarification of the critical problem of welding standardization.

I do not believe many readers of the editorial "Too much regulation!" in the October issue of WELDING ENGINEER, actually realized there were so many code-making bodies in existence. Why can't we concentrate on *what* is right; not so much on *who* is right?

How could there be anything short of confusion in an industry engaged in a common goal, yet highly regulated, restricted and governed by so many mandatory controls with, as you have stated, everybody and his brother trying to get into the act?

Unfortunately, there doesn't seem to be an end in sight to the inconsistent codes, multiple regulations, rigid restrictions and specifications. There is hope, however, in the fact that responsible persons in the welding field have recognized the problem.

Any successful business survives by commanding change, rather than by just drifting. Why not start standardization by recognizing the profession of welding engineering?

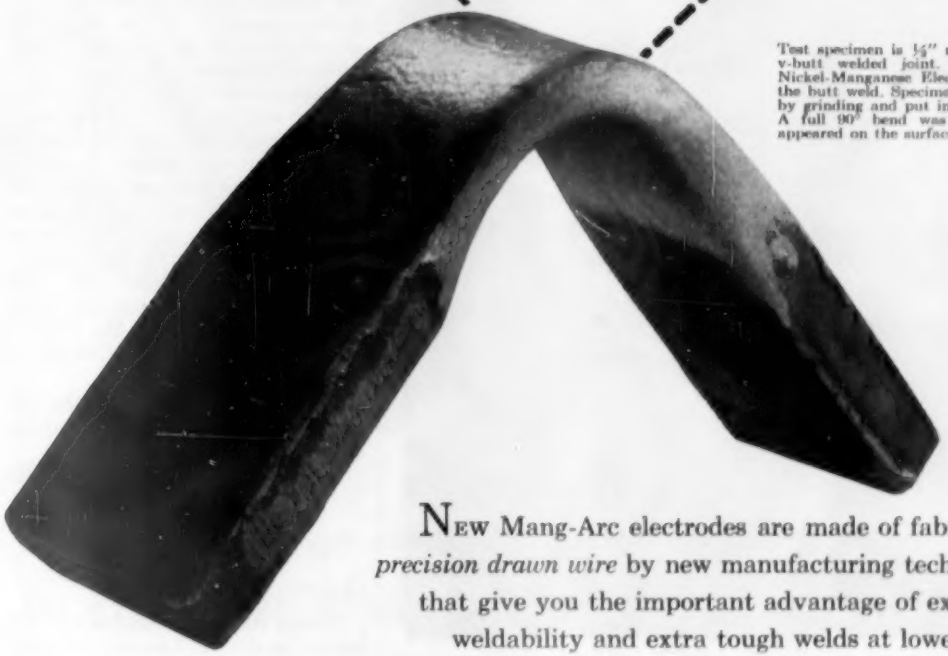
Maybe it is a natural result of a rapidly moving industry with growing pains, but it is time that the application of welding and welding en-

This 90° bend test proves

NEW Mang-Arc

Nickel-Manganese Electrodes

build tough welds!



Test specimen is ½" manganese plate with v-butt welded joint. Bare ⅛" Mang-Arc Nickel-Manganese Electrodes were used for the butt weld. Specimen was then machined by grinding and put in the testing machine. A full 90° bend was made before cracks appeared on the surface of the welded joint.

NEW Mang-Arc electrodes are made of fabricated *precision drawn wire* by new manufacturing techniques that give you the important advantage of excellent weldability and extra tough welds at lower cost!

Mang-Arc electrodes are available bare or coated. Find out how this new Alloy Rods development can save you money. Write for illustrated bulletin on new Mang-Arc Nickel-Manganese Electrodes today.

Alloy Rods Co.

General Offices and Plant
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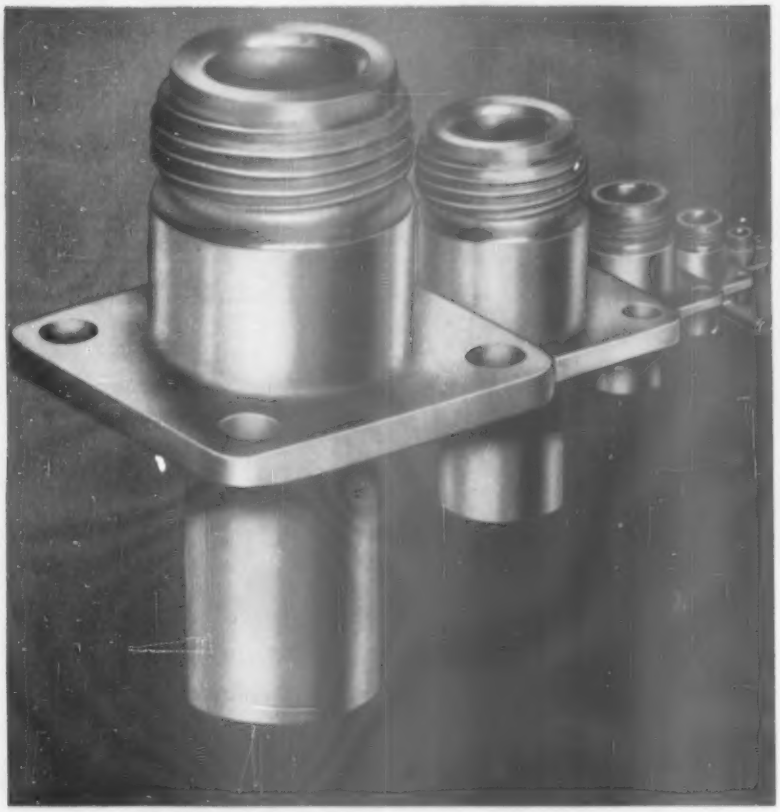
no finer electrodes made . . . anywhere

Joining Metals?

Then **BRAZE** *Them For*

SPEED!



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There are more profitable uses for the time you spend joining metals with old fashioned fasteners! L. T.* brazing saves this time . . . gives it back to you as a "bonus"!

Compare L. T.* brazing time costs with fastening time costs. Or, better still, let us give you brazing time cost comparisons on *your* job through sample lot brazing!

In addition to speed, consider that Phoson and SilBond Brazed-Joints give you high electrical and thermal conductivity, excellent resistance to corrosion . . . and equally important in this age of automation, they lend themselves to mass production methods.

L. T.* braze for speed . . . and for strength . . . and for liquid and gas *pressure-tightness.*

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UNITED *LOW TEMPERATURE* BRAZING ALLOYS

Permanently United

gineering be granted recognition equivalent to other professions.

How many times have these words been heard—we have done it this way for 30 years. No one can dispute the fact that there is a tendency to assume that designing welded equipment is a prerogative of the engineering department, and that application of welding is a shop problem—an attitude with all the earmarks of the bare rod era.

Initiative and ability to recognize a real problem in welding, and the capacity to find the correct solution, be it a fundamental or highly technical one, command a higher respect in industry.

The American Welding Society is the logical sponsor of welding regulations, regardless of the basic field of endeavor. By an organized application of common sense, a system or method should be found by leaders in the welding industry by which welding engineers could be certified by a written examination. A grading system such as that used by the Civil Service Commission would be necessary so that those with practical experience would not go unrewarded.

George Eastman once said. "We must improve everything, and if we think we have reached the limit of improvement on anything, we are on the way out."

Too much regulation is not the only roadblock contributing to the delinquency of welding.

Name withheld

* * *

Why not welding?

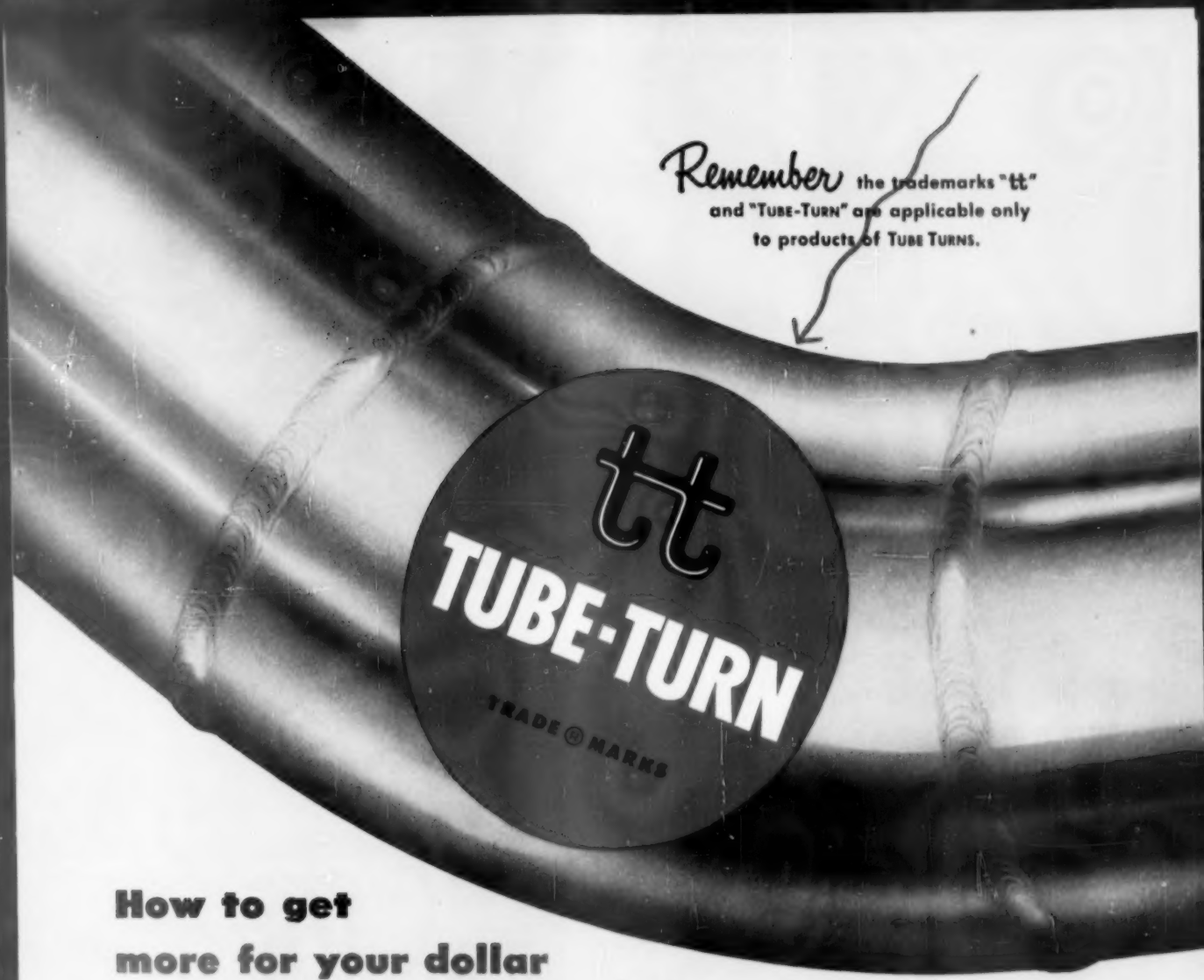
Dear Sir:

During this year, construction was begun on the St. Lawrence Seaway, which divides the United States and Canada, and stretches from the Atlantic Ocean to the Great Lakes. The overall construction cost is estimated to be $900,000,000. This job is, at present, the largest structural steel project being built in this country.

Bridges, dams and a $35,000,000 powerhouse, crusher plants and steel buildings are being built using the *old* principle of riveting.

I am a structural steel weldor, and my main beef is: why isn't welding being employed, why isn't it recognized for the versatile method that it is? Doesn't the Corps of Army Engineers recognize welding as a modern construction tool?

European countries have already used welding on steel construction successfully, especially on steel bridges. Are we in the United States going to take a back seat in employing weld-



How to get more for your dollar in stainless steel fittings!

When you specify TUBE-TURN* Welding Fittings and Flanges . . . regardless of type, size or material . . . you can be *sure* you are getting *top value.* Manufacturing improvements which we are constantly making assure not only unsurpassed quality, but economies which are passed on to you.

In TUBE-TURN Stainless Steel Welding Fittings, for example:

Recent advancements in our production techniques have netted important savings, resulting in price reductions. Are you taking advantage of these savings . . . plus the extra values described on the next page?

TUBE-TURN Welding Fittings and Flanges are made in U.S.A.
They meet *all* U.S. piping code specifications.

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*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

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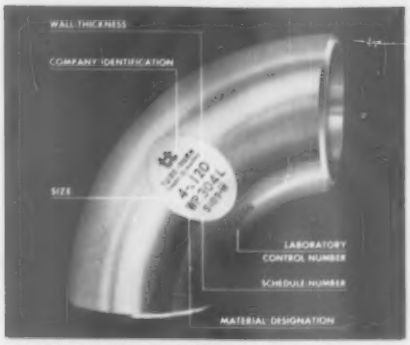
MATCH PIPE for calculated bursting strength.



LONG-LASTING IDENTIFICATION. Lectro-etch markings give complete, permanent information. Fittings have bright, attractive finish.

UNIFORM WALL THICKNESS. Pipe minimum wall thickness tolerance of 87½% of nominal thickness is maintained.

TUBE-TURN*

Stainless Steel Welding Fittings and Flanges offer you these extra values

MEET ALL CODES: ASTM A312 (for material); MSS SP43 and ASA B16.9 (for dimensions); MSS SP25 (marking procedure).

COMPLETE LINE IN STOCK . . . four analyses: Type 304, 304L, 347 and 316. Four wall thicknesses: Schedules 5S, 10S, 40S, 80S.

WALL CHART of dimensions of popular sizes of TUBE-TURN Stainless Steel Welding Fittings and Flanges.

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TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

ing in our steel erections?

President Eisenhower has approved a gigantic road building program which includes many bridges—why aren't some of these bridges all-welded structures?

James G. Brunt
Massena, N. Y.

—Mr. Brunt has raised a piquant question. We would like to see other views on this subject. WELDING ENGINEER *has long realized the need for extension of welding and has consistently advocated its use. We are unable to understand the refusal to profit from the many advantages of welding.*

• • •

Electrode data

Dear Sir:

I wonder if you could tell me whether the American Welding Society has developed a specification for the powder metal electrodes. If so, what series number has been assigned to them and to what series do they belong?

By the way, I have received the Fact-File issue of WELDING ENGINEER, and must say it is a very fine and very complete issue.

W. A. Abrook
Saskatoon, Sask., Canada

—Two specifications have been developed by AWS. E6024 is for use with either a-c or d-c and on horizontal fillet and flat position welds. Its characteristics are like those of the E6012 or E6013 electrode. E6027 is also for a-c or d-c operation on horizontal fillet and flat position welds. It is similar in character to an E6020 electrode. The arc of the E6027 electrode is of the spray type. In operation, it has medium penetration and low spatter loss.

"DON'T BE SO SUSPICIOUS!—THAT BLOWPIPE OPERATOR DOESN'T EVEN KNOW I EXIST!"

Quality is a big part of skill...

Famous Colt "Peacemaker," traditional arm of frontier days and still a favorite of marksmen.

Those who respect quality in performance choose quality tools for the job...

Model H Cone and Chisel one of 27 models

ATLAS TOMAHAWKS

No question about it—good tools produce better results. The name Atlas is standard in shops where weld cleaning is taken seriously. Workers like the balance and "feel" of Atlas Tomahawks and take pride in the better work they produce. You'll like the way they wear, too.

Ask your welding supply dealer to show you the Atlas line

ATLAS WELDING ACCESSORIES COMPANY

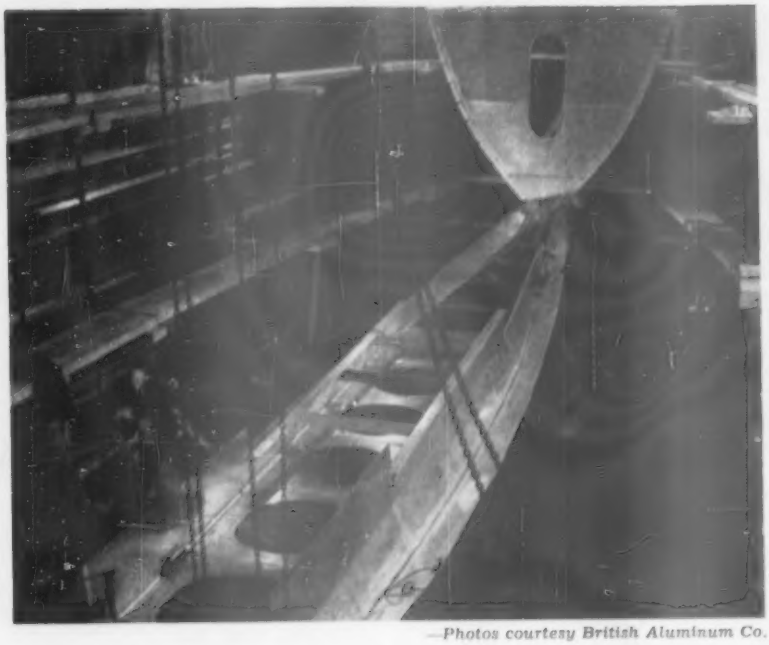
ASK YOUR WELDING SUPPLY DEALER

A good weld cleaning job performed with good professional tools will better reveal the quality of the weld

You Can't Beat ATLAS Quality

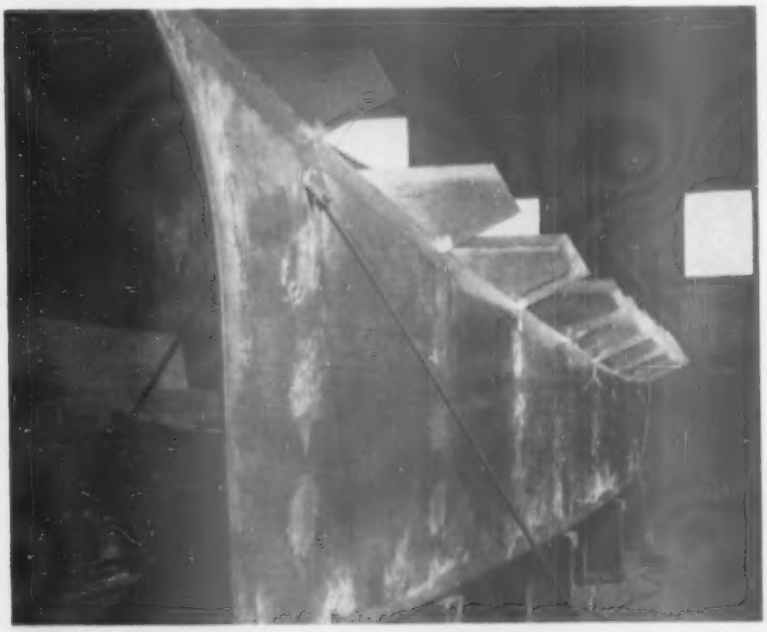
A British firm displays its product by . . .

Welding an aluminum yacht



—Photos courtesy British Aluminum Co.

COMPLETELY framed, the hull is shown partially plated. Hull is framed on longitudinal system. Transverse strength is provided by nine bulkheads and a system of frames about 3 ft apart



STREAMLINED fin provides both center keel and storage space for ballast. Fabricated of welded aluminum alloy plate, fin adds great strength amidships and contains fresh water tanks in upper portion. Deck braces are attached

A 72-FT auxiliary motor yacht, the *Morag Mhor*, recently was designed and built for the British Aluminum Co. to illustrate and further the development of aluminum alloy welding in ship construction.

The hull scantlings of this ocean-going yacht are of a type directly applicable to deckhouses and superstructures of ships, but such deckhouses previously had been of riveted construction.

Designed by Laurent Giles & Partners, Ltd., in cooperation with the design staff of Saunders-Roe, Ltd., the *Morag Mhor* was constructed in the latter's Beaumaris yard.

One of the leading producers of aluminum alloy plate for shipbuilding in the British Isles, the British Aluminum Co. has supplied plate and sections for some of the largest riveted deckhouses and superstructures fitted on British-built ships. It is now pioneering in the welding of aluminum alloys.

Advantages of Aluminum

The advantages of aluminum alloys in yacht building are practical considerations immediately appreciated by owners. The hull is watertight at all times: on first launching, throughout the season in all weather, and during and after a tough sea passage.

The sun cannot open up topside seams during moorings and cause the vessel to leak when "working" a rough passage. Maintenance costs on an aluminum alloy hull are minimal. It will never need re-caulking, nor will replacement of hull members be necessary due to rot—the always-present danger in a wooden vessel.

Another point of some importance is the absence of water absorption. In a wooden hull, this absorption adds considerably to displacement and, after a number of years, tends to make the boat sluffish and slower.

One singular advantage of the metal hull is the opportunity it offers to "build-in" fresh water and fuel tanks, thus saving space and eliminating the necessity for specially-shaped tanks. These reasons may

ROLL CRUSHER PRODUCTION TIME DOUBLED...

using Stoody Semi-Automatic Wires

Roll wear encountered in crushing extremely hard blue granite rock to critical specifications was limiting production at Arizona Sand and Rock Company's portable plant, near Phoenix. Every hour of running time had to be matched with an hour down for maintenance of the rolls! Days just weren't long enough to produce tonnages required and still keep equipment in shape... at least not by ordinary methods.

To avert an impending aggregate bottle-neck, management turned to the new Stoody semi-automatic hard-facing process, set up as a routine repair technique. Time required for maintenance was immediately cut in half... and the hours gained each day were converted to a much needed second production shift!

Low spots on the pair of 40" x 22" rolls are nightly built up as necessary with Stoody 7/64" diameter Manganese. Corrugations are capped with Stoody 100. Both of these alloy materials are supplied in tubular wires for semi-automatic application. High deposition rates—7 to 15 pounds per hour—are several times faster than manual welding. Considerably less heat input is required than by other methods. Deposits are sound and free from porosity. No flux or flux dams block the weldor's view and stub end losses are eliminated.

By permanently installing the semi-automatic welder as part of the crushing equipment no time was lost preparing for nightly maintenance.

If you have maintenance problems on any of your heavy equipment, we'd suggest that you ask your Stoody dealer (check the "yellow pages") for new literature on STOODY ALLOY TUBULAR WIRES, or write direct.

STOODY COMPANY

11941 East Slauson Avenue
Whittier, California

generally be applied when comparing steel and wooden yachts, but there are further advantages which aluminum alloy boats enjoy over those built of steel.

Weight Differential

There is the initial difference between the weights of steel and of aluminum alloy which favors the latter. This factor allows a better deadweight displacement ratio, smaller draft, less displacement and lower power requirements on the same length of hull. The resistance to denting also is greater in an aluminum alloy hull.

Particular interest in the design and construction of the hull of *Morag Mhor* lies in the fact that it was welded with the automatic Mig (metal inert-gas) process, using both American and British-made welders, and is the largest all-welded aluminum alloy hull ever constructed in Britain.

The hull is framed on the longitudinal system, transverse strength being provided by nine bulkheads and a system of frames spaced about 3 ft apart. Shell plating was welded directly to the longitudinals and bulkhead boundary bars, through which the longitudinals are continuous.

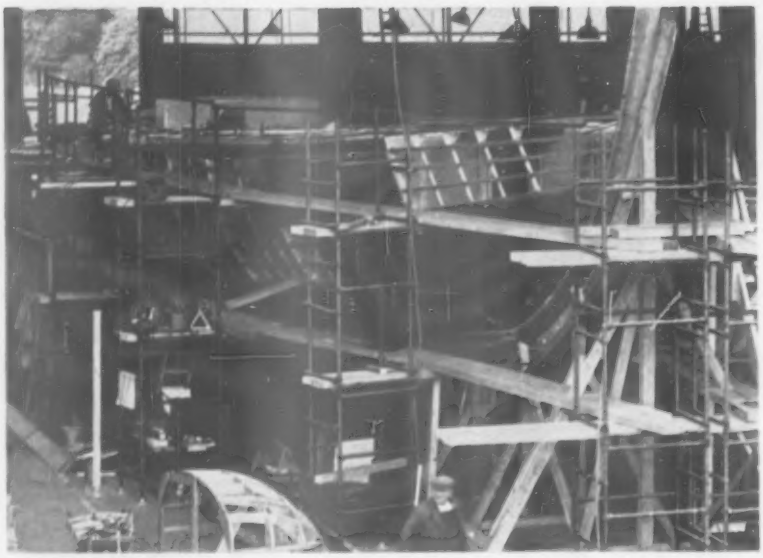
There is no connection to the transverse frames. These were erected on the inboard flange of the longitudinals, to which they were welded. Shell seams, which are butt welded, fall on bulkhead boundary bars. There are 10 longitudinals on each side of the ship.

Center Keel and Ballast

Provision for the center keel and ballast was accomplished by the design of a streamlined fin which, together with the double-bottom construction employed, represents a girder of great strength extending over more than half the length of the boat amidships.

The fin is fabricated of welded aluminum alloy plate, sub-divided by floor plates at each frame and bulkhead. Ballast is stowed in the lower half of the fin, and is thus isolated from salt water and prevented from causing electrolytic action with the hull plating. The upper part of the fin and the double bottom contain fresh water tanks.

Extending over the amidships portion of the hull, the deck edge plate is formed from 0.25-in. thick "flanging quality" plate worked to a transverse radius of approximately 6 in. It is butt welded to the top edge of the sheer strake and the outboard edge of the dock stringer plate.



DOUBLE bottom of auxiliary motor yacht *Morag Mhor* being assembled, with one bulkhead already in position. Automatic Mig (metal inert-gas) welding process was used almost exclusively in fabricating aluminum alloy ship

This form of construction was adopted from the ship-girder-strength point of view, and also to facilitate construction of the hull in this region.

Had this curved deck edge plate not been adopted, a more normal type of construction would have been used, incorporating a gunwale angle. Forward and aft, this gunwale angle actually was used.

The rudder is of double-plate welded construction, with a streamlined cross section, and it is hung on a welded plate-skeg abaft the after end of the keel and propellers. The skeg is faired-off from its maximum width at the rudder post to a thin section at the leading edge.

Superstructure and Masts

The double-skin superstructure is riveted, with stiffeners between the inner and outer skins.

PRINCIPAL DIMENSIONS	
Length, overall	72 ft, 3 in.
Length on datum waterline	60 ft, 4 in.
Beam	16 ft
Draft	7 ft
Displacement	45 tons
Total sail area	1,408 sq ft

Both main mast and mizzen are fabricated from plates 0.25-in. and 0.20-in. thick respectively. They are oval-shaped and were formed by butt welding two plates which were rolled into half-section profiles.

Several sections of mast, about 10 ft in length, have been joined together by circumferential butt welds to make up necssary overall lengths. The main mast, 70 ft in length, is 14 by 11 in., tapering to 6½ in. in diameter at the truck. The mizzen, 46½ ft in length, is 10 by 8 in., tapering to 5 in. in diameter.

Main machinery plant consists of two Gleniffer DB.6 diesel motors, each delivering 72 hp at 1,000 rpm. They are installed with mounted clutches for direct drive through three-bladed, variable-pitch propellers, 26 in. in diameter, and concontrolled directly from the wheelhouse.

The engine's water-cooling system is a closed, re-circulating cycle. Water is cooled while traveling through specially constructed surface cooling tanks built on the shell plating adjacent to the engines.

Built-in main fuel tanks, holding a total 800-gal capacity, are arranged in the engine room wings. A twin-cylinder diesel generator of 3 kwt capacity is also provided.

Deck equipment includes two aluminum alloy boats of welded construction. One is a 12-ft motor launch fitted with a 4-hp marine motor, and the other is a 10-ft sailing dinghy.

Specialty
Safety Products

AO† "H"

Series Face Shields give **Top Value** for Your Protection Dollars

New H-5 has a full crown or spark deflector, new quick-fastening studs in front, and end clips which hold window securely. Chemical splashes cannot enter between window and headgear. Excellent impact protection. Available with acetate windows (clear or green), 24-mesh screen, and fibre. All windows optically correct and extra large (18¼″ x 10″).

H-1. Sturdy, cool and comfortable. Adjustable elastic headband may be worn low on head for additional comfort. Standard Leather Sweatband and Window, snap-on type, are easily replaced. Acetate Windows, Clear or Green, in 3 sizes: (5″ x 11½″; 6″ x 11½″; 8″ x 11½″), and 3 thicknesses (.020″, .040″, .060″). Edge of .020″ thick window aluminum-bound.

H-2. Same as H-1 but with standard spark deflector for added protection.

H-3. Same as H-2 except that back headband is fibre, adjustable, styled to fit lower portion of head snugly. Long band slides within a fibre sleeve, permits easy adjustment, prevents hair pulling. Adjusts by knurled nut.

H-4. Has H-3 features plus full spark deflector for work in tight places where head bumps or lacerations are hazards. Deflector protects forehead and frontal scalp from flying particles. When ordering specify type of shield, size, thickness and shade of window. Refer to AO Eye Protection Catalog, S-2363, Page 54. Or ask your nearest AO Safety Products Representative.

New H-5 Face Shield unique features simplify window interchange

12458-3 Straightaway Sound Protector

MUFFLES HARMFUL PLANT NOISE

A new addition to AO's Sound Protectors. Accommodates larger ears, cuts out harmful noise. Headband is rugged, adjustable, padded. All connections insulated. Oval shaped ear cups fit snugly, stay comfortably in place, seal opening at jawbone section. Available with built-in earphones.

†T.M. Reg. by American Optical Company

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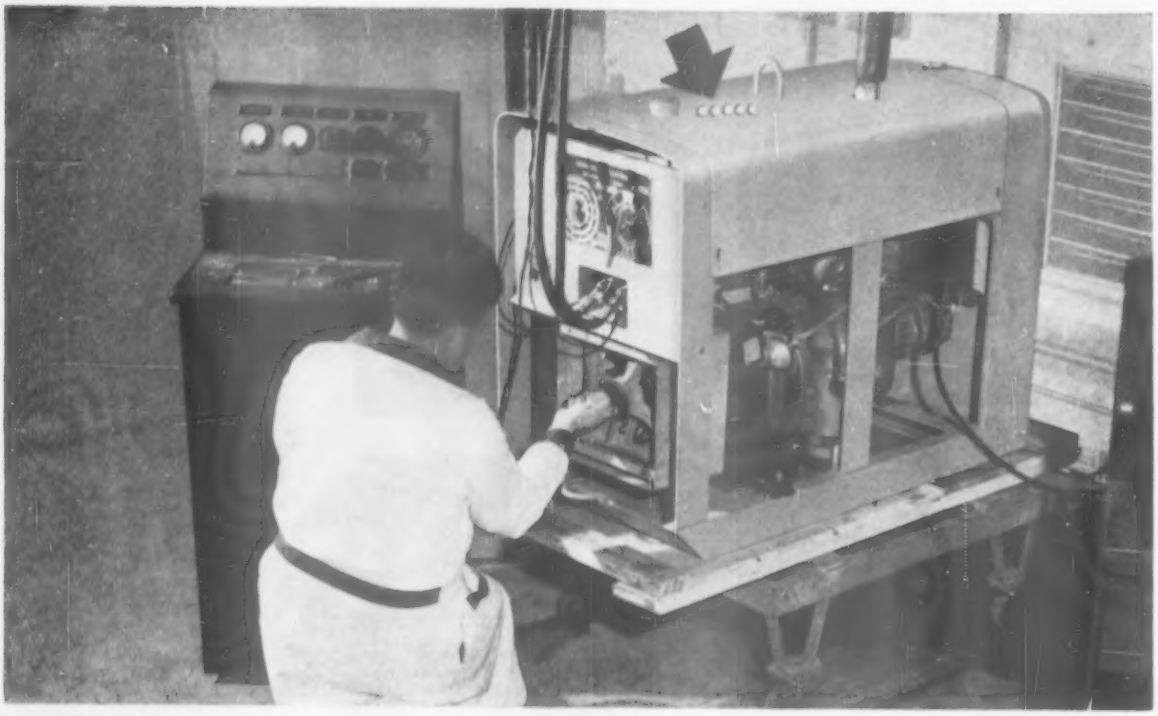
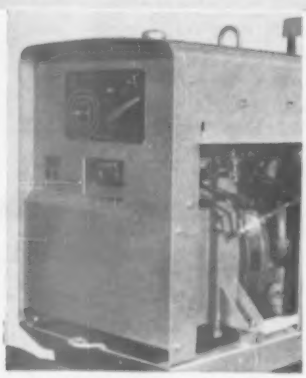


5 NICKELS STAND ON END while the new G-E 200-amp welder runs at full load. This unusually steady operation demonstrates the advanced engineering thought which makes the G-E engine-drive welder your best performance buy.

PROVE IT TO YOURSELF— Make this actual feature-by-feature comparison of the new 200-amp G-E engine-drive welder with two other welders of the same rating. You will see that only the new G-E welder has so many advanced design features for better welding performance at lower cost.

ELECTRODE SELECTOR, CURRENT DIAL—Dual controls simplify current control, give you easier, more accurate adjustment.



NON-PROJECTING GENERATOR—No vital parts are exposed. Full-length base encloses generator for rugged in-the-field welding.

PUSHER ENGINE FAN—Air is blown out of radiator, helping to prevent vapor lock.

GENERAL ELECTRIC	✓	✓	✓
MANUFACTURER A			✓
MANUFACTURER B			

Hour After Hour, at Full Load

...WITH GENERAL ELECTRIC'S ALL NEW 200-AMP ENGINE-DRIVE WELDER

General Electric's new 200-amp engine-drive welder eliminates one of the welding operator's common complaints—excessive loss of amperage and arc heat when operating the welder at full load for a sustained period.

This powerful welder is equipped with a direct-connected Hercules engine and specially designed generator. This combination maintains steady output and 100% arc stability—hour after hour—even when operated above full load. And no matter what type or size of electrode you use, or where you set the controls, this G-E welder provides complete freedom from "pop-outs." This is due to the high recovery voltage of the welder.

Six months of rigorous in-the-field testing by 18 pipeline welding operators has already proved that the new G-E engine-drive welder has that extra punch needed for top performance in job shops, on construction, and similar welding operations.

Only the new G-E welder has so many features that assure superior welding. With "rugged simplicity" built in, the G-E welder has fewer parts, sturdier construction for longer life.

Check below to see how this welder compares with other make welders, feature by feature. Then make your own test.

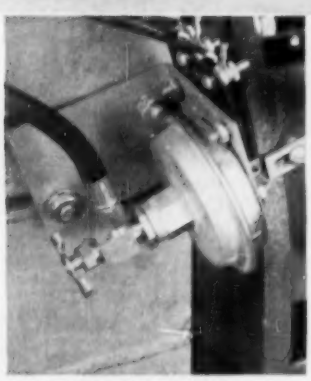
For more information, write for bulletin GEC-1333, Section 714-1, General Electric Company, Schenectady 5, New York, or contact your nearby G-E Welding Distributor. He's listed in the yellow pages of your phone book. And ask him also about General Electric's new special electrodes for construction—W-610A and W-710A. 714-1

Progress Is Our Most Important Product

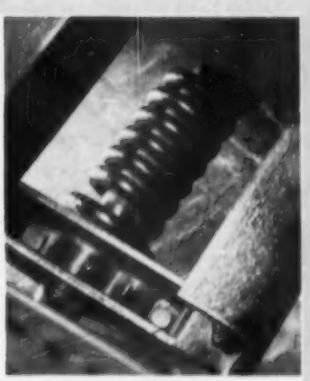
GENERAL ELECTRIC

CONSTANT PRESSURE BRUSH SPRINGS—New feature eliminates need for adjustment.

HEAVY-GAUGE METAL THROUGHOUT—16-gauge canopy, 3/16-in. channels, 1/4-in. cross bars withstand rough field conditions.



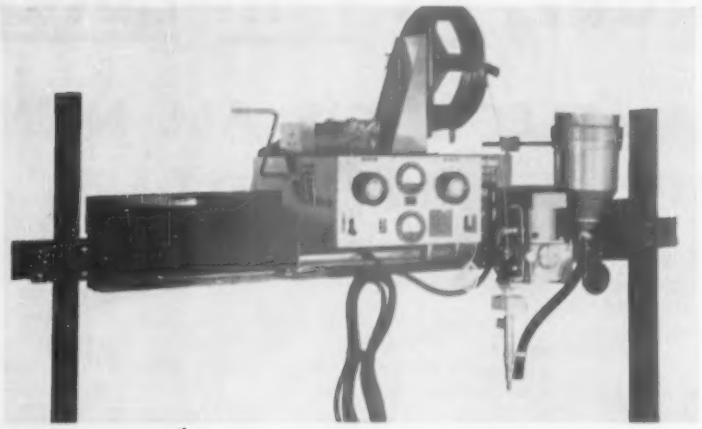
OVER 12-HOUR OPERATION—New slowdown control and 17-gallon tank give more than one shift operation on a tank of gas.



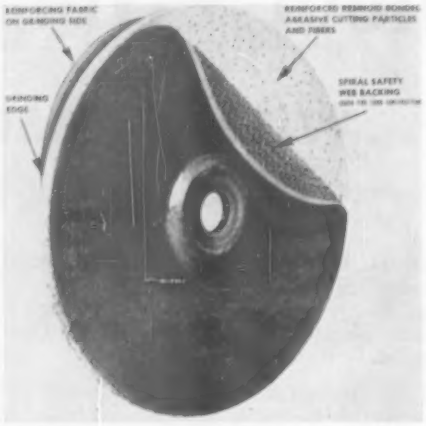
SPRING-WOUND TRAILER AXLE—New construction of axle reduces side sway and weaving for easier towing, better tracking.

✓	✓	✓	✓
	✓	✓	

new products . . . . . USE CARD ON PAGE 101



MOTOR-DRIVEN beam carriage is designed for operation with automatic welding head.


REINFORCING FABRIC ON GRINDING SIDE
REINFORCED RESINOID BONDED ABRASIVE CUTTING PARTICLES AND FIBERS
SPIRAL SAFETY WEB BACKING
GRINDING EDGE

RUGGED abrasive wheel has special construction for efficient grinding.

Welder carriage

BEAM carriage is for use with models "ASM-5D" and "ASM-5T" automatic welding head. Carriage can be equipped to perform submerged-arc, inert-gas or open-arc welding.

Drive is supplied by 110-volt d-c motor. A set of spur gears provides two travel speed ranges. Low speed range is 8 to 75 ipm and high speed range is 75 to 300 ipm. Friction roll propels carriage on six permanently lubricated sealed rollers.

Pulling down crank to left of control panel disengages drive roll, simultaneously raising welding head. Carriage can then be positioned manually. An adjusting screw, just below head mount, can raise or lower head. *Hobart Bros. Co.*

Circle No. 1.

* * *

Weldment braces

BRACES of formed steel are for use in weldments. Two types are available, "U" and "V". Both types are said to give fuller load support, better alignment of component parts of the weldment. *Conner Steel Products.*

Circle No. 2.

* * *

Electrode

IRON-powder electrode "Improved Fleetweld 47" is for all-position welding. It is for use in high-speed welding of mild steel, with either d-c or a-c. Bead appearance is said to be smooth and clean, with minimum spatter. Slag is claimed practically self-cleaning.

The arc is smooth, soft and stable in all positions and has no tendency to stick on a-c or d-c, states manufacturer. Electrode can be operated with drag or short arc technique. It is available in 1/8 to 5/16-in. diameters. *The Lincoln Electric Co.*

Circle No. 3.

* * *

Automatic welder

UNIQUE welding machine is designed for production welding. An automatic six-station rotary index machine, it presses, induction-preheats, performs two running spot argon shielded-arc welding operations, wire brushes and automatically unloads an internal gear and stamped hub assembly at the rate of 260 per hour.

Machine has unusual fixture arrangement. Air-powered clamping fixtures, which hold the two parts, are tilted by cams to various angular positions, during index through work cycle. Gear drives in each fixture rotate parts at welding and wire brushing stations. *Expert Welding Machine Co.*

Circle No. 4.

* * *

Welding wire

SPOOLED "Phos-Trode" wire (AWS-ASTM E Cu Sn C), having 8% nominal tin content, is available in 0.045, 1/16, 5/64 and 3/32-in. diameter sizes. It is layer-wound on spools or rims for deposition with the Mig (metal inert-gas) process.

Packaged in 25 lb cartons, the wire is recommended for bearing and corrosion-resistant applications; also for joining copper, tin bronzes, brasses, etc. *Ampco Metal, Inc.*

Circle No. 5.

Abrasive wheel

LIGHTWEIGHT, rigid-type, reinforced resinoid-bonded abrasive wheel is for use on portable disc type and right-angle type portable grinders. Termed "Simex Red wheel", it has a special safety web backing of spiral wound rayon auto tire cord.

This wheel is for production grinding, particularly for grinding welds, removing flash and bead, cleaning rough ragged surfaces and edges.

Wheel is made in depressed center or raised hub shape in 7 and 9 in. diameters by 3/16 and 1/4 in. thicknesses. *Simonds Abrasive Co.*

Circle No. 6.

* * *

Dust collector

"AERODYNE" dust collector is a complete unit consisting of a louvered cone and one or more fiber filter packs in series. Unit will remove all solids and most condensable fumes, it is claimed.

Classed as type "GWF Aerodyne", this unit is available in capacities from 1,000 to 10,000 cfm free air. Power requirements range from 1½ to 15 hp, with the motor assembled with the unit. *Green Fuel Economizer Co.*

Circle No. 7.

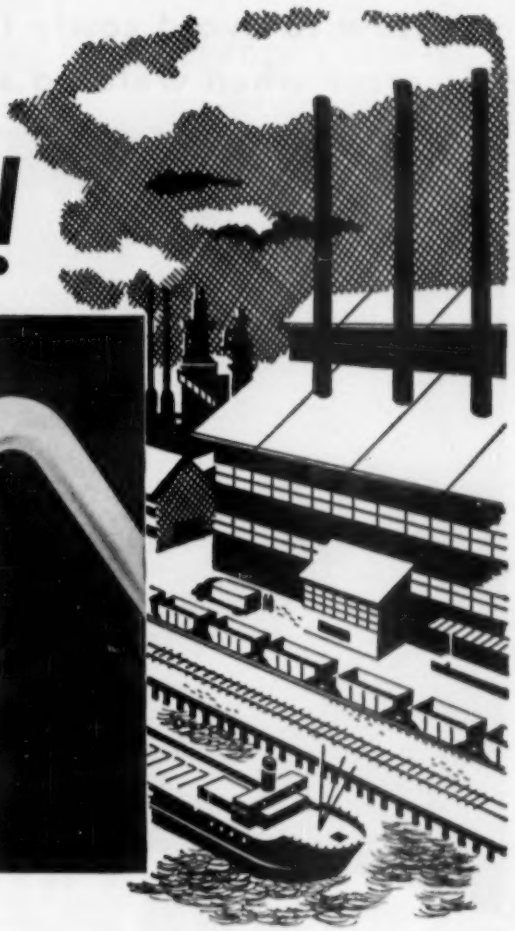
* * *

Electrode

ELECTRODE, "Ampco-Trode 10", is for braze-welding 16 and 18-gage mild steel. Electrode has 5/64-in. diameter. It is claimed to have exceptional arc action, no spatter to clean, fast deposition, and require minimum of grinding. *Ampco Metal, Inc.*

Circle No. 8.

TERRIFIC HEAT !

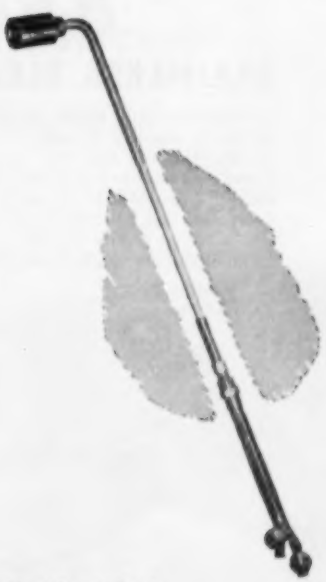


HARRIS SUPER-HEAT TORCH NO. K23

Heat is the Prime Factor utilized in connection with innumerable Metal Working Operations. While it is a fact that the Oxy-Acetylene Welding Torch is universal in its applications, there are many Operations requiring a much greater volume of Intense Heat than can be obtained from a Welding Torch.

A definite limitation exists relative to the amount of Oxygen and Acetylene Gases which can be safely mixed without danger of the Flame "Back-firing", due to the extremely fast Flame Propagation Characteristics of such Gas Mixtures. On the other hand, much larger volumes of such Fuel Gases as Propane, City Gas and Natural Gases can be safely mixed with Oxygen on account of their lower rate of Flame Propagation. It is evident the larger the volume of Gases mixed, the greater the Flame and resulting Heating Value. This produces the truly phenomenal results achieved by this Harris Super-Heating Torch.

The applications of this Harris Torch are unlimited, where large volumes of Intense Heat are required, either as a Portable or Stationary Unit. In places where Massive Shafts are to be Straightened; Large Size Pipe Bent; Flanging or Straightening of Steel Plates; Brazing Heavy Copper Pipe, etc., etc., this Harris Torch, with its **TERRIFIC HEAT**, is the answer.



HARRIS 1903 50 1953 ANNIVERSARY

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THE HARRIS CALORIFIC COMPANY
CLEVELAND 2, OHIO

How to avoid costly trial and error when welding stainless

WELD WITH ARCOS

STAINLESS ELECTRODES

For truly *stainless* welds use ARCOS Electrodes. Trial and error electrode selection is risky when expensive equipment is involved—such as the food processing kettles pictured above. There's a complete line of ARCOS Electrodes—quality-controlled and ELECTROPAKED—to assure uniform performance in welding equipment that must withstand corrosive service. Try Arcos and see how easy it is to deposit sound welds—at low cost. ARCOS CORPORATION, 1500 South 50th St., Philadelphia 43, Pa.

Welding positioner

POSITIONER is designed as a universal holding fixture for welding and production operations. "Magic Positioner" is composed of three powerful, Neoprene covered, permanent magnets, mounted in a die cast aluminum frame.

Scales, graduated in 5 deg, give 360 deg adjustment (with locking device), providing accurate positioning, states manufacturer.

Magnets have 45 lb pull; locking feature is controlled by knurled knob. Positioner is also available in 2-magnet and 3-magnet models, with 30 or 45 lb lift. *Standard Portable Cord Co., Inc.*

Circle No. 9.

* * *

Toggle clamp

SMALL toggle clamp, "Model 2-15-U" is for lightduty jobs requiring positive clamping. Holding pressure is 150 lb. Clamp has adjustable bolt assembly. Slight thumb pressure gives instant clamping action. A touch on the underside with the forefinger gives release. Total weight is 4 oz; overall length, in closed position, is 5 7/16 in. *Detroit Stamping Co.*

Circle No. 10.

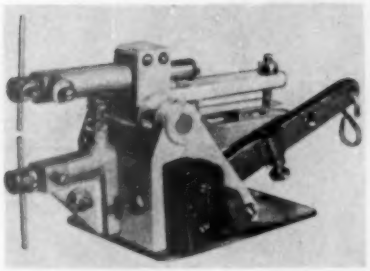
* * *

Hardfacing

WELDING additive "W. C. Basic" is for use in hardfacing of metals. Additive is a mixture of alloying elements and flux and can be applied by gas or arc welding technique, states manufacturer. It is claimed to eliminate need for many specialized alloy rods now necessary in hardfacing.

In gas applications, additive is applied by heating the rod and dipping into "W. C. Basic", causing alloying elements to adhere to the rod and enter weld deposit. A variety of different rods, including high or low carbon wire, stainless steel wire, may be used, it is claimed. Additive is said to require no special preparation of parent metal. Additive is available in 2-lb containers. *Western Carbide Corp.*

Circle No. 11.



Welding head

SINGLE electrode welding head is said to be adaptable to a variety of small-part hand welding operations. Unit is said to supply continuous electrode pressure. Head is adjustable micromatically; pressure is applied through a cam acting against deflection of a cantilever spring.

Unit operates by depressing a foot pedal. Power for operation is applied by capacitor discharge power pack. Head is 5 by 4 in. high; 12 in. deep. *Federal Tool Engineering Co.*

Circle No. 12.

* * *

Grinding wheel

Two large diameter "Grind-O-Flex" wheels—10 and 12 in. diameters in 1 or 2 in. widths—are now available. The larger wheels are designed for heavy duty light grinding, burr shagging and polishing of flat or contoured surfaces. They may be used on light equipment or in automatic set-ups.

Wheels come in full range of grits (from No. 40 to 320) and may be used in operations ranging from smoothing off flash to high polish. ed spindle. *Merit Products, Inc.*
Wheels have flanges to fit any thread-

Circle No. 13.

* * *

Abrasive saw

HUGE plate-cutting abrasive saw is for cutting of heavy stainless steel and aluminum plate. Machine is a straight line abrasive cut-off saw, with mounting resting on six concrete piers. A 21-ft cutting bed serves as a rest for material being cut.

Main drive is 30-hp motor that operates the 20-in.-diameter abrasive cutting wheel at 10,000 smf. Lateral movement is supplied by electronically-controlled hydraulic unit, providing variable speeds from 0 to 20 fpm. One operator guides three-directional movements of machine by push button. Unit is 24 ft long and can cut plate up to 240 in. long. *Peter A. Frasse & Co., Inc.*

Circle No. 14.

For more information use card on page 101

A sure way to meet every demand when welding high strength steels

WELD WITH ARCOS

LOW HYDROGEN ELECTRODES

Low hydrogen electrodes are no "stepchild" at Arcos. They're manufactured under the same high standards as stainless—to meet exacting conditions. For example, welds in a dipper that will chew out 45 cu. yds. of stony soil in one bite must be strong, and must resist abrasion, shock and fatigue. Where strength is of primary importance, Arcos ELECTROPAKED Low Hydrogen Electrodes, frequently without preheat, are the "sure way" to get quality weld metal . . . . easily deposited every time. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.

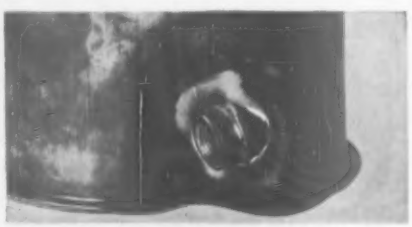
SERVICE

makes EASY-FLO and SIL-FOS your top brazing alloy buy

That the EASY-FLO and SIL-FOS low-temperature silver brazing alloys are tops for speed and economy, stands proved beyond question in their years of wide-spread use throughout Industry.

But what makes them your *top brazing alloy buy* is – the SERVICE that goes with them . . . a service freely given to all EASY-FLO and SIL-FOS users with no obligation . . . a service that places at every user's call the maximum technical knowledge about silver brazing and practical experience in its application available today – backed by outstanding engineering and research departments . . . a service ready to assist on any and all phases of silver brazing from joint design right through into production.

THIS TYPICAL EXAMPLE well illustrates how valuable this service can be. A manufacturer was brazing steel spuds into steel shells with EASY-FLO 45. Pull tests showed some joints not up to strength. A call brought a field service engineer. He found that, in flattening and piercing the shell for the spud, oil and dirt were being pressed into the metal. He recommended degreasing the parts and keeping punch press tools clean. He tried this out on a number of shells. Upon test the joints all held – the shells tore away. There's been no trouble since.



SEND FOR THE DISTRIBUTOR LIST

EASY-FLO and SIL-FOS Distributors cover the country. They're specially selected and qualified to supply and serve you. The list will tell you the address of the one nearest you. Write for it – today.

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LOS ANGELES, CALIF.
TORONTO, CANADA
MONTREAL, CANADA

There's no "...or equal" for EASY-FLO and SIL-FOS

Magnetic ground

MAGNETIC unit makes a positive ground to any shaped object, quickly and securely, states manufacturer. Rugged aluminum body of "Welders' Ground Hog" is said to cause improved electrical contact. Pole faces on three sides permit use as a welding fixture to hold small pieces during welding assemblies. Unit weighs 1¼ lb. *Magne-Cast Tool Co., Inc.*

Circle No. 15.

* * *

Work positioner

HYDRAULIC work positioner "No. 393" is air powered. Unit features remote touch control. Primary source of power is compressed air at 60 to 100 psi. Factory air system is connected through a foot pedal into an air-hydraulic booster cylinder. Air pressure is multipled and converted to hydraulic pressure, which is transmitted through a shielded hose into the body of the positioner.

Unit has a universal ball-and-socket arrangement, free to move through all three planes. Toe touch locks positioner in desired angle and position; reversing foot pedal releases air pressure from system enabling rotation of work. Unit has work weight capacity of 105 lb. *Wilton Tool Mfg. Co., Inc.*

Circle No. 16.

* * *

Grinder loader

LOADING attachment, for cylindrical grinders, automatically loads work pieces between centers and removes them when ground. It can be adapted to wide variety of small parts that can be rolled, by gravity, on inclined rails, permitting operator to attend batter of machines.

Device is of the turret type, supporting the work near both ends. A number of work pieces may be placed on loading rails by hand or fed to the loader from a conveyer. Latches separate parts and operate to release a single piece at a time to the turret. *Norton Co.*

Circle No. 17.

P&H Arc Welders

SAVED $120,000

—free report shows how

You weld faster, better, at much lower cost with P&H welding equipment, because P&H designs and builds with an eye to improving your production and profit.

You're assured of top quality welding from P&H Arc Welders because the arc is easy to strike . . . and has stability with constant heat. Lowest possible maintenance costs are another advantage of P&H Arc Welding equipment, since there are no moving parts to wear or get out of kilter. Read about these P&H money-saving features, and many more in the complete, impartial report offered here. There are a lot of ideas too, that may save you money.

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the P&H *Line*

P&H welding equipment is manufactured and sold in Canada by REGENT EQUIPMENT MANUFACTURING COMPANY LTD., 455 King Street West • Toronto, Ontario, Canada

The "Missing Link" automatically PROVIDES INERT GAS SHIELDED ARC ON ANY MACHINE

Model No. 13-D "Missing Link"

The "Missing Link" circuit serves either AC or DC. Needs no auxiliary switch.

The "Missing Link" No. 13-D, with its advanced-type circuit, converts any arc welding unit into a universal machine *for AC, or DC, inert gas shielded* or metallic arc welding! It is smoother operating and more quiet running than ever. Reduces operator fatigue. And it provides smoother, denser welds.

The 13-D also has continuously variable intensity control . . . precise adjustment for all high frequencies — retaining, of course, outstanding advantages of Mid-States fully automatic gas, water, afterflow and complete operation by remoto control. Send for details today!

Mid-States Model 310, 7-300 amps. with Model 13-D "Missing Link."

Mid-States Arc Welders
CUT COSTS with These 7 Features

Automatic Arc Starting • Instant Amperage changes • Welds Ferrous and Non-Ferrous Metals • Unvarying Output, No "Creeping" • No Pressure to Cause Pinholes • No Moving Parts • 100% Penetration — Smoother Beads

ACCEPT Mid-States SIMPLIFIED *WELDING* Brochure *FREE!*

Comes along with "Missing Link" information—complete literature of Mid-States line. Write today!

Mid-States WELDER MFG. CO.
6029 SOUTH ASHLAND AVENUE • CHICAGO 36, ILLINOIS

Safety spectacles

GOLD lenses for inspection use are interchangeable for insertion in "Tucaway" safety spectacle frames. Lenses are said to reduce eye fatigue and strain by softening glare and absorbing harmful ultraviolet rays. At the same time, objects are made clearer by improving contact between black and white.

Lenses are optically perfect, made of 0.080 in. thick shatterproof plastic. Lenses resist damage from flying particles and will not pit from grinding or welding sparks, it is claimed. Lenses are available with either full side shield or full cup protection. *Watchemoket Optical Co.*

Circle No. 18.

• • •

Grinder

SPECIAL purpose grinder can be adapted to a wide range of cylindrical grinding operations. Termed "Type CMS-1," this semiautomatic multiwheelslide grinder can plunge-grind multiple diameters simultaneously on workpieces which, because of shape, are difficult to grind.

Grinder has sturdy, unitized wheel slides. They may be opposed or placed in line. Slides operate in unison during production. Each wheelslide mounts one or more 30 in. diameter grinding wheel, as needed. *Norton Co.*

Circle No. 19.

• • •

Hardfacing paste

HARDFACING paste gives high hardness deposit and good abrasion resistance, claims manufacturer. This "Hi-C 60 Ruf-Nek" paste can be used on any metal whose melting point is higher than that of the paste (1,850 F.) A permanent suspension of powdered hardfacing alloy in a water base solution, the paste can be applied by spatula, brush or by extrusion from a tube. It is available in tubes or jars. *Superweld Corp.*

Circle No. 20.

Why be almost right...

THERE'S AN EXACT WESTINGHOUSE ELECTRODE FOR YOUR SPECIFIC JOB

For better welding performance let Westinghouse welding engineers help you select the *right* rod for your particular application. Whether it's mild steel, low alloy steel, stainless steel, cast iron or hard surfacing, the broad range of Westinghouse types and sizes assures you of an electrode best for you—best for top welding results at lower cost in your particular application.

FREE samples on request—Try a quality Westinghouse electrode on your toughest job. Ask for a free sample from your Westinghouse welding distributor, or use coupon below. Be sure to specify type of job involved.

FREE welding guides—These helpful manuals can save you welding dollars. Send for your copies, today. J-21837

YOU CAN BE **SURE**...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC CORPORATION
Welding Department
P. O. Box 868, Pittsburgh 30, Pa.

Please send me literature on the items checked below:

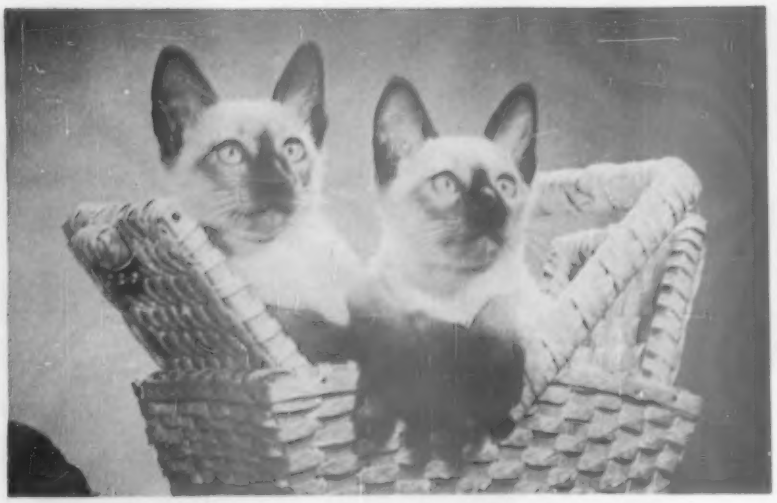
- ☐ Complete Line Electrodes (B-6070)
- ☐ Cast-Iron Electrodes (B-6076)
- ☐ Stainless Steel Electrodes (B-6077)
- ☐ Mild Steel Electrodes (B-6078)
- ☐ New RA Welder (B-6129)
- ☐ New TA Welder (B-6367)
- ☐ Free Electrode Samples for (type of job)_____

NAME_____

COMPANY_____

ADDRESS_____

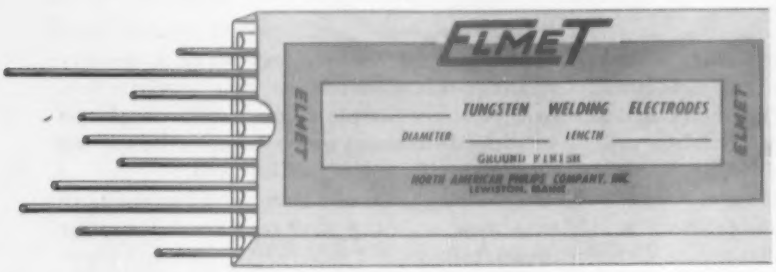
CITY_____ ZONE_____ STATE_____



ALIKE AS TWO ELMET ELECTRODES

Nature does it without even trying, but on the production line it takes a lot of human skill to attain absolute uniformity. In the making of Elmet tungsten electrodes, however, the result is well worth the extra effort. For Elmet electrodes are completely uniform, not only in surface finish and dimensions, but more important, in their composition, characteristics and physical structure. This means that, with Elmet, you get consistently superior performance from electrode to electrode with a minimum in readjustment of equipment and voltage.

Elmet pure tungsten and thoriated tungsten electrodes are furnished in cleaned finish and in the mirror-smooth centerless ground finish. They are available in packages of 10 in all standard diameters from .040" to ¼" and from 3" to 18" in length.



Why not place a trial order with your distributor today, or use the coupon below to obtain full information and an informative folder on tungsten electrode welding.

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NEW PRODUCT BRIEFS

Hydraulic vise for production line work is controlled by two foot pedals, leaving operator's hands free for handling and positioning. *Columbian Vise & Mfg. Co.*
Circle No. 21.

• • •

High-frequency generators for induction and dielectric heating have compact design and durable steel frames. Water-cooled motor generators are used for adequate cooling. *New Rochelle Tool Corp.*
Circle No. 22.

• • •

Inspection light permits close examination of hard-to-see areas by bending light around corners by means of focusing light and mirror. *F. T. S. Corp.*
Circle No. 23.

• • •

Piston-type pressure switch for high-speed, automatic, heavy metal-working duty, is said to accurately sense any system pressure over an adjustable range of 35 to 12,000 psi, with a proof range of 4,500 to 20,000 psi. *Barksdale Valves.*
Circle No. 24.

• • •

Lightweight steel bar clamp, with multiple disc clutch for good grip, ranges in capacities from 6 to 24 in.; all sizes "reach" 2½ in. from bar. *Adjustable Clamp Co.*
Circle No. 25.

• • •

Safety guard for circular saw has transparent plastic shield for full view of work operations. Guard protects during cut off, grooving and ripping. *General Scientific Equipment Co.*
Circle No. 26.

• • •

Heavy-duty "Axial Airfoil" fans are designed in eight general categories, for ventilating under all kinds of conditions. *Chicago Blower Corp.*
Circle No. 27.

• • •

Layout fluid is brushed onto metal surface for layout work, using either pencil or steel scriber. *Dayton Rogers Mfg. Co.*
Circle No. 28.

• • •

Electrical foot switch is for use with production machinery requiring fast, safe switching. It can be activated by hand, elbow or knee. *Birtcher Corp.*
Circle No. 29.

For more information use card on page 101

NEWS . . . . . *from page 6*

in which 13 speakers participated.

While all of the speakers brought stimulating ideas to the 113 persons present, the address by Bob Gadberry, Fourth National Bank, Wichita, Kans., will be remembered as a high-point of the meeting. D. R. Cawthorne, Federal Reserve Bank, Kansas City, Mo., stated that the future for business is extremely bright. He cautioned, however, that we must continue to do our part to keep it that way.

Harry Moore, Moore's Welding Supply, Sacramento, Calif., was chairman of the NWSA Western Zone meeting, held at the Ambassador Hotel, Los Angeles, Nov. 3 and 4. This meeting, which 146 distributors, manufacturers' representatives and guests attended, proved to be one of the largest (and most enthusiastic) Western Zone meetings ever held.

Preliminary meetings were held Wednesday evening, Nov. 2. Three sessions, jam-packed with information, followed.

Lead-off guest speaker, Jesse Tapp, Bank of America, Los Angeles, spoke of "The Dynamic Western Economy." Edward Morgan, Kierulff & Co., Maywood, Calif., presented many excellent suggestions for better sales training.

Delegates showed considerable interest in a discussion of the three types of welding distributors. Final speaker, Frank R. Chase, Torit Mfg. Co., St. Paul, Minn., ended the meeting with his address "Look out for your outlook."

Ask NWSA membership

The following firms applied for membership in National Welding Supply Association during the Western Zone meeting, Nov. 3 and 4 in Los Angeles: Fresno Oxygen & Welding Suppliers, Fresno, Calif.; Lemaster Oxygen & Equipment Co., Long Beach, Calif.; Oxygen Supply & Equipment Co., Portland, Ore.

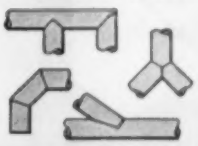
* * *

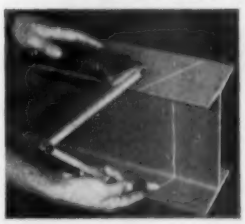
Oxyacetylene use competition announced

International competition for a paper on the uses of oxyacetylene has been announced by the Commission Permanente Internationale de L'Acetylene de la Soudure Autogene, Paris, France. Papers may be submitted from January 1, 1956 to December 31, 1956. The competition is open, with exception of members of the Commission, to any individual or organization.

LAY OUT ANY PIPE JOINT

LAY OUT ANY PIPE JOINT, SHOWN BELOW, on any size pipe from 1½" to 48"





Mark Structurals
Adapter for marking structural angles included with either model of the Contour Marker.

The proven, fast easy way

IN LESS THAN 5 MINUTES you can lay out a Y, a T, an L or any angle joint with a Contour Marker. IT'S EASY and absolutely accurate; it is calibrated in both degrees and pitch. Just set the angle and with a smooth swing of the Contour Marker's soapstone point you are ready to cut! You save "man hours" as well as oxygen and acetylene gas because "cut and try" methods are eliminated.

Two Sizes: Standard, for pipes 1½" to 18" dia.; Jumbo, for pipes 16" to 48". Instruction book included. Belt case available. Write for information.

Sold by welding supply dealers everywhere.

CONTOUR MARKER CORP. OF CALIFORNIA
1843 East Compton Boulevard, Compton, California

BOYCE CENTERING HEAD marks *center line* at any degree of angle on pipe, shaft, tube. Leveling gauge on dial.

24" RADIUS MARKER is folding compass of Dural aluminum. Folds to 9¼" pocket size; weighs 8 oz.

PIPE FLANGE ALIGNER expands and centers inside pipe to align flange for welding. For any pipe dia. 3" to 12"

THE *Original* CONTOUR MARKER
ACCURACY PROVED BY TEN YEARS OF SERVICE TO WELDERS

40 YEARS with WELDING

Welding has changed the world's concept of metal joining during these past 40 years.

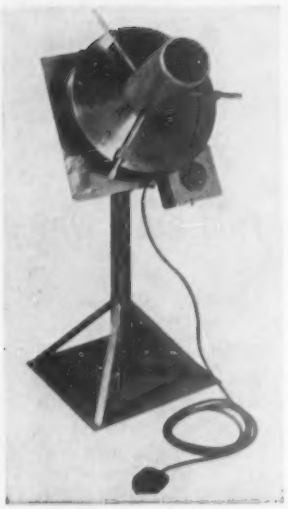
All the milestones of this great achievement will be depicted in WELDING ENGINEER's big 40th Anniversary Issue, which will commemorate the four decades that it has served the industry.

Closing date: Dec. 5.

Contact your local representative or write

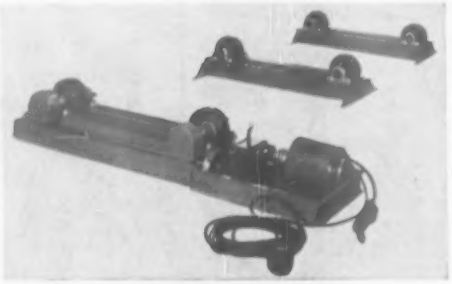
WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill.

Positioning produces STRONGER, CLEANER, BETTER WELDS *in less time by eliminating* HANDLING



Light-duty Bench and Floor Model Positioners
Capacity 150 lb.

Single-Column Post-Types
Capacities from 500 lb.
to 36,000 lb.



Powered Turning Rolls and Idlers
Capacities from 500 lb.
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Frame Base Powered Turning Rolls
All wheels driving.
Capacities to 100 Tons.

Specializing in Custom Equipment
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UNIQUE TURN TABLE & EQUIPMENT CORPORATION
122 SUMPTER STREET BROOKLYN 33, N. Y.

Cemented carbide brazing developed

A practical production method has been developed for brazing cemented chromium carbide with silver alloy filler metals. The new method is the joint effort of Carboloy Dept. of General Electric Co., Detroit, and Handy & Harman, New York City.

The new technique will open the way for wider use of cemented chromium carbide in applications in the 600 F range, it is claimed. The alloy could not be previously used because of poor joining methods. Successful brazing, in the past, meant using an atmosphere of pure dry hydrogen or using filler metals of high silver and manganese content. Such methods were not adaptable to economical production.

The new process, utilizing Carboloy grade 608 cemented chromium carbide, allows brazing, in air, without special equipment, using commercially-available silver alloy filler metals.

The technique employs a brazing flux containing powdered boron. Due to its property as a strong reducing agent, boron is able to dissolve the tough chromium oxide film. Best results have been obtained with a combination of the boron and a silver alloy filler metal.

* * *

New use of metals at Armour Research

A metallurgical technique, which may lead to a new use of metals, has been developed at Armour Research Foundation of Illinois Institute of Technology, Chicago.

The technique, known as fiber metallurgy, involves use of a bulk starting form of metal heretofore not used —short metal fibers. Application of the new method can result in bodies with novel properties. It would be possible to make products having a wide range of porosities combined with relatively high strength and toughness, according to Armour scientists.

* * *

South African firm holds welding clinic

A welding clinic and demonstration of welding methods was recently conducted by Union Liquid Air Co. (Pty.) Ltd., Johannesburg, Union of South Africa. On display were up-to-date oxyacetylene and electric welding and cutting equipment, welding accessories and safety equipment. Exhibitions were given of the various types of welding.

ASM awards Gold Medal

The American Society for Metals has awarded its 1955 Gold Medal to Alfred L. Boegehold, assistant to vice-president in charge of the research staff, General Motors Corp., Detroit. The medal was given to Mr. Boegehold "in recognition of his great versatility in applying science to the metal industry." The award was made at the society's annual dinner at Philadelphia, Pa.

SNT Coolidge Award

Winner of the annual W. D. Coolidge Award of the Society for Nondestructive Testing, Daniel Polansky, received the honor during the recent National Metal Exposition and Congress held in Philadelphia. The award was based on work done by Mr. Polansky, in collaboration with D. T. O'Connor, on the development of industrial photofluorography.

Photofluorography is a miniature-film technique that promises tremendous savings in costs of inspecting industrial products. It is a method of reducing X-ray images in size so that they can be focused. A fluorescent screen, sensitive to X-rays, is interposed between the object and the film. The visible light, excited from the screen by X-rays, can then be projected onto any size film desired.

* * *

National Electronics adds to plant

Projected additions to the Geneva, Ill., plant of National Electronics, Inc., will provide 60% increase in total floor space. The firm manufactures industrial electronic tubes, including those used in resistance-welding controls.

* * *

Standard Portable Cord moves to larger plant

Standard Portable Cord Co., Inc., formerly at 1300 E. 2nd St., Jamestown, N. Y., has moved to larger facilities. The firm's new address is P. O. Box 141, Mayville, N. Y.

* * *

Virginia Welding adds new service

Virginia Welding Supply Co. has added a new loading dock which extends across the back of its plant. The dock, which is 80 ft long and 20 ft deep, provides additional 1,600 ft storage area. The dock floor, of 7-in.-steel-reinforced concrete slab, is able to carry a minimum of 500 lb per sq ft and can accommodate a fork lift truck.

FOR BEST RESULTS USE

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Silver Brazing Alloy preforms for Production Brazing. Rings, Stamped or Coined Washers and Wire Forms

All inquiries given immediate attention and shipments made on short notice. Technical service men are available to assist you in proper joint design. Silvaloy brazing alloys also available in wire, strip, and powder from stocks in six branch warehouses.

1200 FLUX

Use when silver brazing Brass, Bronze, Copper, Nickel-Silver, Steel, Stainless Steel, Monel, Nickel, Inconel and other Nickel alloys. Furnished in ½ lb., 1 lb., 5 lb., 30 lb., and 65 lb. containers.

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THE ALL NEW Weldit SINGLE STAGE Regulator

The Weldit Series 55 Single Stage Regulator is designed to meet the requirements of modern industry. It is precision built for longer life and is easily repaired without special tools.

- Top Performance
- Low Cost
- Rugged
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990 OAKMAN BLVD.
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If you are looking for **PERFORMANCE**

PLUS **ECONOMY**

in an **ELECTRODE HOLDER**

***INSIST** on your dealer showing you a*

HI-AMP

The PI-5 HI-AMP shown here, is the most economical 500 amp. Electrode Holder on the market by *far*—and you can easily prove that statement by insisting on your dealer showing you this new model. It was developed especially for iron powder "contact" rods, as well as hard surfacing rods. Note too its extra heavy lower jaw which allows heat to be absorbed, thus insuring longer life—weighs only 26 ozs.

Yes, just check the many outstanding advantages of all HI-AMP products and you will quickly learn why welders everywhere now insist on HI-AMP Electrode Holders and Clamps for outstanding performance *plus* economy!

Sold only through Welding Supply Distributors in the U. S. and Canada

Weld with Wagner

WAGNER MANUFACTURING CO.

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HOW TO use and apply alloys and fluxes for Soldering, Brazing and Welding Aluminum and Aluminum Alloys

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Handiest Pocket Reference is designed Particularly to service operator needs Brief • Direct • Available on Request

This small folder is for the man at the torch or welding machine . . . will help him recognize the alloy made especially for the job he has at hand . . . will refresh his knowledge of exactly how to use it. FREE! Single copies or sufficient numbers to supply weldor crews.

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TWO NEW SOLDERS FOR JOINING ALUMINUM TO OTHER METALS

105 **Medium Temperature Solder** Good for 18,000 psi Shear. This low cost silver solder requires no more than 750 F. for joining wide range of ferrous and non-ferrous metals.

107 **General Purpose Silver Solder** Stronger—20,000 psi shear—and requiring only 600 F. Like 105, good for aluminum, copper, brass, stainless steel, etc.

Your A-S Distributor Now Stocks Both 105 and 107. Ask to see what problems they can solve for you.

ALL-STATE WELDING ALLOYS CO., INC., WHITE PLAINS, N. Y.

J. W. Goodliffe builds new Allentown branch

A new branch in Allentown, Pa., built by J. W. Goodliffe & Son, Linden, N. J., was scheduled to begin operations last month. The building is designed to handle cylinders and welding machines at truck level. Booths have been included for conducting welding schools.

* * *

RWMA guests of Westinghouse

Members of the Resistance Welder Manufacturers' Association were guests recently at a meeting held by the Motor & Control Division, Westinghouse Electric Corp., Buffalo, N. Y. Included in the program was a number of talks covering latest developments in control systems.

* * *

Nickel mining film available from Inco

"Mining for nickel" is a 45-minute, sound-color film that outlines the history of nickel mining in the Sudbury area of Canada and covers, in detail, the original development of a mine. Prints are available from The International Nickel Co., Inc., New York City.

* * *

Seal-Seat Co. in larger quarters

Seal-Seat Co., which manufactures seals, diaphragms and gaskets, recently moved into new and larger quarters at 2326 Sawtelle Blvd., Los Angeles. The firm was formerly at 1913 S. Grand Ave. in that city.

* * *

Welding show

—Minneapolis Star photo

AT welding show sponsored by Dunwoody Industrial Institute, Minneapolis, and Northwest section of American Welding Society, John Markwell, welding instructor, explains new oxygen-cutting equipment. Students are Siswanto, left, and Pratomo (they have only one name) of Indonesia.

COMING EVENTS

DEC. 5-6: Southeastern Zone Meeting, NWSA, The Dinkler Plaza, Atlanta, Ga.

DEC. 8-9: Southwestern Zone Meeting, NWSA, Shamrock Hotel, Houston.

JAN. 1: Fortieth Anniversary of WELDING ENGINEER.

JAN. 4-5: Job Shop Welding Conference, Iowa State College, Ames.

FEB. 22-24: Welding Applications Institute, University of Wisconsin, Madison.

FEB. 1-2: Second Annual Midwest Welding Conference, Armour Research Foundation of Illinois Institute of Technology, Chicago.

MARCH 12-14: Fifty-sixth Annual Convention, International Acetylene Association, Hotel Statler, Los Angeles.

MARCH 19-22: Twelfth Annual Convention, National Welding Supply Association, Hotel Roosevelt, New Orleans.

MAY 8-11: Thirty-seventh Annual Meeting, American Welding Society, Hotel Statler, Buffalo.

MAY 9-11: Fourth Annual Welding Show, Memorial Auditorium, Buffalo.

AEC selects new site for headquarters

The U. S. Atomic Energy Commission plans to build a new headquarters building near Germantown, Md., 23 miles from Washington, D. C.. The exact boundaries will be determined after completion of engineering surveys.

* * *

Tank not purged, fumes fell worker

Poison fumes from a tank supposedly containing oxygen recently overcame seven employees of a New York City valve repair plant. While one of the men was repairing the tank, hydrogen sulfide fumes burst forth. The repair worker was seriously injured by a cut on the scalp when he fell unconscious. His fellow workers carried him to fresh air.

This case illustrates the danger of improper handling. The tank, and several others to be repaired, were all believed to have contained oxygen or acetylene before being emptied.

* * *

To discuss job-shop welding at Iowa State

Job-shop welding will be the subject of a conference, Jan. 4-5 at Iowa State College, Ames. The program will cover electric arc and oxyacetylene welding. Topics will include modern methods for the job welding shop, welding stainless steel and aluminum, blueprint reading and hardfacing.

Where a few POUNDS mean more than a few YEARS

Safety and *long life* are prime considerations in the design of Harrisburg High Pressure Gas Cylinders. Yet they are as light as sound engineering permits, without a pound of excess weight. True, we might shave off a few more pounds, but it would entail shaving off more than a few years from their life expectancy.

Industry expects a quarter-century or more of safe service from compressed gas cylinders, based on long experience with the Harrisburg product. Industry can continue to do so, for Harrisburg Cylinders will always be built for a long and safe future. Send for prices and literature.

More than a century in Harrisburg

Harrisburg Steel

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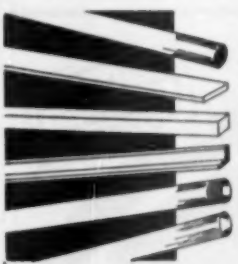
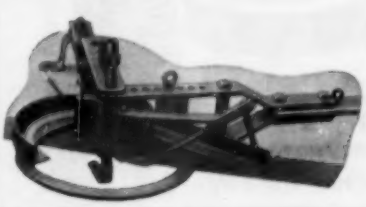
HARRISBURG 8, PENNSYLVANIA



ROUNDS
FLATS
SQUARES
ANGLE IRON
PIPE
TUBING & CONDUIT

Bend ALL These on ONE Machine the HOSSFELD UNIVERSAL® IRON BENDER

Wrenchless, the Hossfeld Bender is always ready for use. It's easily and quickly set up for 101 different bends needed every day in maintenance and production work. Adaptable, it replaces special bending equipment. For those hard-to-pull bends on heavier material, a Hydraulic Attachment (available optionally) enables one man to do the job.



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Sample bendings of:

- Bar
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446 W. 3rd St.
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WELDS 2 PIECES OF 1/8 INCH STEEL!

Welds 18 gauge steel 100 spots a minute... lighter gauges even faster!

Featuring the new

TRANSOIDAL

(A development of the toroidal coil)

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THE BREN-WELD

SP-100 SPOT WELDER

Obsoletes All Other Welders of Comparable Rating!

- TRANSOIDAL welding transformer with radially wound primary
- Double glass insulated and baked windings
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- Heavy-duty, 3" diameter double-acting air cylinder
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- Controls mounted on one side panel for convenience
- Modern functional cabinet design; no attached boxes or switches
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- Welding arms up to 36" supplied at extra cost
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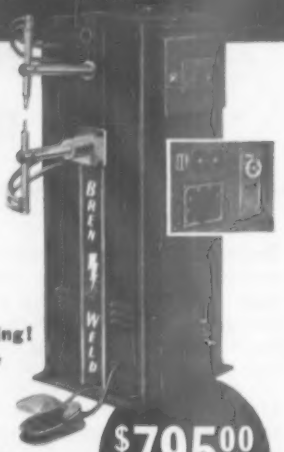
- Draws 50 Amps. at 220 volts, single phase

24 HOURS DELIVERY FROM STOCK!

Write for 4-page, color brochure containing complete specifications



$795.00

List Price, F.O.B. L. I. City, N. Y.

Size: 70" x 20" x 51" (less welding horns)

Unconditionally Guaranteed for a year!

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SALES DIVISION
KASSON DIE & MOTOR CORPORATION
INTEGRITY SINCE 1919
32-14 Northern Boulevard, L. I. City 1, New York

A KASSON PRODUCT

AT THE FRONTIERS OF PROGRESS YOU'LL FIND

FOR WELDING AND CUTTING...

IN THE RED DRUM

HIGHEST QUALITY

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AN AIR REDUCTION PRODUCT

NATIONAL CARBIDE

Write for the name and address of the NATIONAL CARBIDE supplier nearest you.

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Confounded by definitions?

If you have ever been annoyed by differing uses of terms, your help is needed. A new handbook, in the process of preparation, aims to summarize fundamental principles and basic design data in the field of ordnance engineering. This field cuts across many areas of science and technology. Information for design work comes from many fields of knowledge.

If you have either formal or informal collections of terminologies, glossaries, specialized dictionaries, or even references to them, you are asked to write: Allen Kent, associate director of Center for Documentation & Communication Research, School of Library Science, Western Reserve University, Cleveland.

* * *

ASTM radiographs for weld defects

Reference radiographs covering types and degrees of discontinuities in steel welds have been approved by the American Society for Testing Materials, Philadelphia. There are 35 radiographs in the form of transparencies mounted in 5 by 8 in. cards.

Details of plate thickness, radiographic method and welding procedures are given on each card. The transparencies, although reproduced to a density level of approximately 1.0, retain the original radiographic contrast. The complete file of 35 transparencies is available for $50 per set from ASTM headquarters in Philadelphia.

* * *

Alco to build Army power reactor

Alco Products, Inc., Schenectady, N. Y., has begun construction of an Army package power reactor at the Engineer Research & Development Laboratory, Ft. Belvoir, Va. The plant will generate 2,000 kw of electricity, for use in normal post operations, when completed in early 1957.

* * *

Norelco offers X-ray film

"The Ultimate Structure" is a 40-minute, black and white film on X-ray diffraction and spectrography. It outlines the way elements and compounds are identified and measured through studies of atomic structure. It is available from Research & Control Instruments Div., North American Philips Co., Inc., Mt. Vernon, N. Y.

Chickens held by welded shackle

A new welded shackle, manufactured by E. H. Titchener & Co., Binghamton, N. Y., is designed for chicken processing plants. The welded wire unit features two tapering slots in which the chicken's legs are inserted and held by the bird's own weight. A "V" shape in the center of the shackle holds the chicken's head.

* * *

Inspection firms join forces

Warnock Hersey Co., Ltd., Montreal, and Canadian Inspection & Testing Co., Ltd., Toronto, recently joined forces in order to increase services to customers. Both firms, however, will continue to operate under their original names and with the same staffs.

* * *

Norelco sponsors meet on emission microscopy

A special two-day symposium on emission microscopy, sponsored by the Research & Control Instruments Division, North American Philips Co., Inc., Mount Vernon, N. Y., was scheduled to meet November 21 and 22. The meetings aimed at bringing together scientists, research and management personnel for discussion of techniques and applications of emission microscopy.

* * *

Distributor appointments

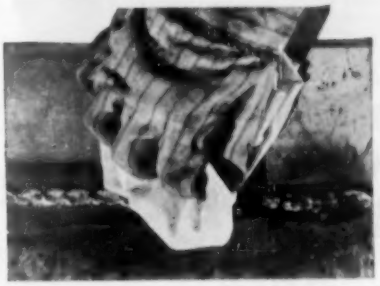
American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.: Interstate Welding Sales, Marinette, Wis.; Red Ball Supply, Inc., Oklahoma City, Okla.; Spencer's Industrial Sales & Service, Fallon, Nev.; Superior Oxygen Co., Houston; Williams Co., Louisville, Ky.

Ampco Metal, Inc., Milwaukee: Will Process Equipment Corp., Rochester, N. Y.; The Condit Co., Tulsa, Okla.; A-L Machine & Equipment Co., Franklin Park, Ill.; Rawdon Myers Agency, Cincinnati; Paul B. Duggan, Chicago.

Eutectic Welding Alloys Corp., Flushing, N. Y.: E. W. Sales & Welding Service, Inc., Chicago.

Harnischfeger Corp., Milwaukee: Charles W. Krieg Co., Newark, N. J.

K-G Equipment Co., Inc., Allentown, Pa.: Gordon's Welding Supply Co., Glens Falls, N. Y.; Joseph Hurwitz Co., Butler, Pa.; Temple Iron & Metal Co., Temple, Texas; Travis Welding Supply Co., Dallas; Welding Sales Co., Orange, Conn.; WP-RS Mars Co., Duluth, Minn.



cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time — P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke, odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic, water-soluble paste. Inorganic. Thin before applying and start welding at once. $3.30 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of subassemblies. $3.35 per gallon, f.o.b. Dayton.

MONEY-BACK TRIAL OFFER

Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

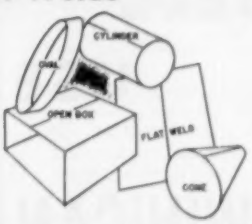
PROTECT-O-METAL

G. W. SMITH & SONS, INC. 5408 KEMP ROAD, DAYTON, O.

AIRLINE'S "KNOW-HOW" AT YOUR DISPOSAL

THESE TWO FIXTURES CAN GIVE YOU ACCURATE — SMOOTH — PRESSURE TIGHT Fusion Butt Welds

If you make these → *You need these* →



AIRLINE MODEL LW SERIES 1000
Longitudinal Welding Fixture

Manufactured in 2 ft. to 12 ft. lengths. "Toe touch" control permits controlling fingers from any position. Welds sheets, cones, cylinders, boxes, etc., from .010 to one inch thickness. Suitable for MIG, TIG, submerged-arc and hand welds. Available also as complete package.

AIRLINE MODEL R 4000
Planishing Roll—60 Inch Throat

High Roller Face Pressure. Cold works welds and adjacent areas, flattens and smooths fushion welds, increases mechanical properties, reduces grinding. Also flattens flash welds, mash welds, resistance welds and elongated weld areas. Diameters 1¾ in. to 10 ft., and to 10 ft. lengths on large diameters.

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CARBON WELDER BRUSHES

for all types and makes of welding equipment

Everything you need from *one* source, with *one* responsibility. The fast, economical way to order. Catalog gives complete specifications, factory numbers, scaled drawings, etc. Write for your free copy today.

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GLENN COMPANY CONSTANT VOLTAGE *News Notes*

CV Welders Double Field Welding Capacity

More than a score of major U.S. fabricating firms are using GLENN CV welders to increase capacity, speed welding and reduce rejects on fabrication and erection of tanks, pressure vessels and structures.

High efficiency (85% or higher) and power factor (90%-plus) of GLENN welders is a big advantage in field welding. Input power is half that of reactive welders of comparable rating. Welding capacity of the same power source can thus be doubled—or the same welding ouput achieved with a much smaller portable generator.

GLENN CV welders are delivering outstanding performance on MIG, submerged arc, CO-2, semi-automatic, and automatic stud welding. They've licked tough control problems on 3 o'clock, roundabout and long seam welds. Why not find out what they can do for you? Write today for complete data, prices.

GLENN COMPANY CONSTANT VOLTAGE PIONEERS
3134 E. 10TH STREET
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Richard A. Stumm has been elected a vice-president of U. S. Industries, Inc., New York City. Mr. Stumm is president of Southern Pipe & Casing Co., Azusa, Calif., a firm recently acquired by U. S. Industries.

* * *

Birny Mason, Jr., has been elected secretary of Union Carbide & Carbon Corp., New York City. He has been assistant secretary and assistant treasurer of the corporation since 1954.

* * *

Charles Brown has been appointed manager of the new southern division of All-State Welding Alloys Co., Inc., New York City. He will supervise regional offices at New Orleans, St. Louis, and Concord, Tenn., and Birmingham. Mr. Brown is a member of the American Welding Society. He will headquarter at the newly established office, 3 Pamona Drive, Birmingham. His former associations include training director for Rust Engineering Construction Co. and Atlas Powder Co.; welding consulting service to the U. S. Army and Navy Arsenals, AEC contractors and the U. S. Air Force.

* * *

John P. Manley has been named sales manager of General Ceramics Corp., Keasbey, N. J. He was formerly eastern regional sales manager of Indiana Steel Products Co.

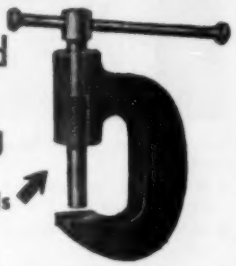
* * *

W. H. Collins has been appointed northeastern district sales manager, Trent Tube Co., subsidiary of Crucible Steel Co. of America, East Troy, Wisc. He will headquarter in New York City.

* * *

Alfred H. Pope, of the administrative staff of the Pennsylvania Salt Mfg. Co.'s metal processing chemicals department, has been named sales representative in Cleveland succeeding *James Keers*, who was recently transferred to Detroit.

"Red Head"
WELDING CLAMPS



• Designed for Welding •
No Threads To Damage

1. Case hardened threads are always protected from weld spatter and never exposed to damage in open or closed position.

2. The clamp body is cut from solid plate, thereby insuring extreme rigidity and giving great resistance to bending or twisting.

3. Heat treated chrome molybdenum alloy handle offers great resistance to bending.

23 stock sizes

CHICAGO BOILER COMPANY
1968 CLYBOURN AVENUE
CHICAGO 14, ILLINOIS

No. 45 The RIGHT FLUX for the JOB No. 43
No. 44 No. 28H

BACKED BY 60 YEARS OF TESTED PERFORMANCE

Whatever the particular job you have to do—we have the right FLUXINE you need. Besides our 25 FLUXINES we carry a complete line of "KOP-R-ARC" coated rods for welding copper and all copper alloys.

Write on company letterhead for chart and generous sample stating which FLUXINE desired.

KREMBS & COMPANY
(Est. 1875)
Dept. J, 669 W. Ohio St., Chicago 10, Ill.

R. C. Brown has been appointed director of research for Caterpillar Tractor Co., Peoria, Ill. He succeeds *J. M. Davies*, named assistant to the director of engineering and research. *Dale Wright* has been named chief metallurgist by Caterpillar, following the retirement of *Glen C. Riegel*. Wright has been associated with the firm since 1934. He has been active on committees of the American Welding Society.

* * *

E. J. Weller, manager of tool sales, Carboloy Department, General Electric Co., Detroit, has been named manager of a newly established carbide products design engineering section.

* * *

George L. Hammon is president of the recently incorporated Hammon Precision Equipment Co., Emeryville, Calif. With over 32 years experience in manufacture of welding and cutting equipment, the firm is now engaged in custom design and production of welding equipment, and air-gas products.

* * *

William L. Clark has been appointed product manager of "Alcoplate" process by Alco Products, Inc., Schenectady, N. Y. He will be in charge of all phases of the method of chemical nickel plating.

* * *

William E. Hibbard recently joined Superweld Corp., North Hollywood, Calif., as an application engineer. He had been field engineer for Fabriform Metals, Los Angeles.

* * *

W. M. Champion has been appointed district manager of the Shreveport, La., sales office of Air Reduction Sales Co., New York City. He succeeds *John Lund*, who has resigned.

* * *

Marion Reese has joined the sales staff of Aweco Supply Co., Tucson, Ariz.

* * *

James Hagarty has been appointed sales representative in the Midwest area by P. R. Mallory & Co., Inc., Indianapolis. A member of the American Welding Society, Mr. Hagarty has had more than 18 years of experience in various specialized welding fields. He will be located at the firm's district office in Chicago.

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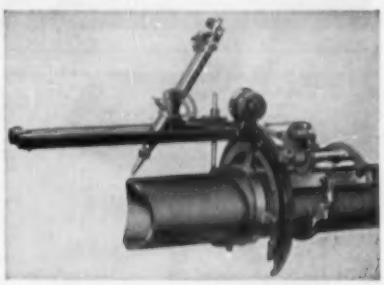

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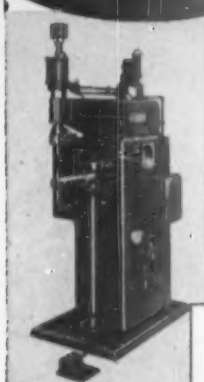

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* * *

Harry Schwartzbart has been named supervisor of welding research in the metals research department, Armour Research Foundation of Illinois Institute of Technology, Chicago. He was previously research metallurgist. Before joining the Foundation, he served three years as a research metallurgist for the National Advisory Committee for Aeronautics, Cleveland. He joined ARF in 1951 and has specialized in projects involving welding, brazing, soldering, and mechanical metallurgy. He is a member of the American Welding Society.

* * *

H. A. Huff, Jr., welding specialist, was recently appointed regional process representative for the Southwest region, Air Reduction Sales Co., New York City. Mr. Huff will headquarter in Houston. He is a member of the American Welding Society.

* * *

Died . . .

Niels P. Lunn, purchasing agent of Fansteel Metallurgical Corp., North Chicago, Ill., died recently at the age of 57.

* * *

James Currie, manager of plant facilities, Alco Products, Inc., Schenectady, N. Y., died recently. He was 64.

* * *

Aaron B. Bagsar, retired chief metallurgical engineer of Sun Oil Co., Philadelphia, died recently. He was 58. Dr. Bagsar was a member of the special subcommittee on metals of the American Bureau of Shipping. During World War II, he was a member of a subcommittee of the War Production Board and the armored plate welding research committee of the National Academy of Sciences. Dr. Bagsar was a member of the American Welding Society. He retired in 1954.

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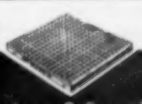
Welding  **Platens**

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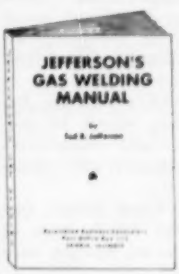

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53. RESISTANCE WELDING—The Taylor-Winfield Corp. Actual manufacturing problems in resistance-welding operations are treated in No. 557 of *Weld-It*.

54. WELDOR'S CLAMP—Grand Specialties Co. 11-page booklet (C-9-52) catalogs types of welding clamps, with descriptions and uses.

55. RADIOGRAPHY—Metal & Thermit Corp. 24-page illustrated booklet describes industrial radiography using "Kel-Ray" portable gamma ray projector.

56. BLAST CLEANING—Wheelabrator Corp. Bulletin No. 100-D treats cleaning of weldments by the table-type airless blast-cleaning machine.

57. AUTOMATIC WELDERS—Morton Mfg. Co. Bulletin No. 48 discusses automatic welders, machining tools and special machinery used in production.

58. ACCESSORIES—The Burdett Oxygen Co. 4-page folder describes cylinder connections, bushings, welding accessories, including helmets and goggles.

59. ELECTRODE HOLDER—Wagner Mfg. Co., Inc. Folder and catalog sheet list and describe electrode holders, ground clamps, cable connectors.

60. CIRCUIT BREAKER—Allis-Chalmers Mfg. Co. "Low-Voltage Air Circuit breakers" is a folder treating low-voltage air circuit breakers for welders, heaters, transformers.

61. GRINDING WHEELS—Norton Co. "How to select grinding wheels for precision grinding, tool and construction steel" is booklet illustrated with photographs and charts.

62. WELDING ROD—Coast Metals, Inc. 4-page illustrated folder details types of tungsten-carbide hardfacing welding rods available.

63. CLAMPS—Lapeer Mfg. Co. 70-page catalog (Form 10-55) contains descriptions and specifications for fixed, mounted and portable clamps.

64. FLAME-CUTTING—Arcair Co. "Fundamentals of flame-cutting" is a booklet giving the basic rules for good performance with a hand torch. Illustrations are included.

65. DUST CONTROL—Aget Mfg. Co. Two bulletins (Nos. 636-3 and 622-3) offer practical engineering information on "Dustkop" industrial dust and vapor control.

66. SCALING, CHIPPING—Master Pneumatic Tool Co., Inc. Bulletin 1010A describes and illustrates models of scaling and chipping hammers for weldors.

67. ABRASIVE—Bay State Abrasive Products Co. Folder (Form 158) treats "Griteloth," an abrasive-coated, open-mesh fabric for use in deburring and finishing of metals.

68. SKIN DISEASE—Association of American Soap & Glycerine Producers Inc. "The prevention of occupational skin diseases" shows major causes with preventives and aids for protection against skin irritants. Of value to weldors are mechanical and physical sections.

69. ELECTRODE—Ampco Metal, Inc. Sheet (PO 10-137) describes "Ampco-Trode 10" bronze electrode for joining and overlay applications.

70. SOFT SOLDER ALLOYS—Alpha Metals, Inc. Sheet outlines in chart form special soft solder alloys, with brief descriptions and suggested uses.

71. STUD WELDING—KSM Products, Inc. 15-page booklet gives designs and specifications for arc-welding studs, pads, pins.

72. WELDOR'S HAMMER—Bernard Welding Equipment Co. Catalog sheet (Form MP 5) illustrates and describes weldor's hammer.

73. WELDING PEDESTALS—Cayuga Machine & Fabricating Co., Inc. Bulletin No. 5305 treats the "Cayuga-Matic" pedestal for heavy-duty precision welding.

74. WELDERS—Thomson Electric Welder Co. Bulletin 327 describes seam welders for circular or longitudinal welding.

75. POSITIONERS—Aronson Machine Co. 4-page folder explains, with illustrations, construction and uses of heavy-duty gear-driven welding positioners.

76. ELECTRODE—Pacific Welding Alloys Mfg. Co. Pamphlets describe silicon bronze electrodes for either a-c or d-c welding.

77. TERMINALS—Advanced Vacuum Products, Inc. 4-page folder (AVP-55-3) treats high-voltage terminals for high temperature service.

78. COMBUSTIBLE GAS DETECTOR—Johnson-Williams, Inc. Descriptive sheet (Form G-755) explains lightweight portable indicator for detection of combustible gases.

79. STAINLESS STEEL—Crucible Steel Co. of America. Data sheet No. 3 outlines characteristics of "Rezistal 316" stainless steel, with attention to its welding properties.

80. MIG WELDING—Linde Air Products Co. Illustrated folder presents the process of spot, plug and tack-welding using the Mig (metal inert-gas) method, with description of equipment.

81. HEAD, EYE PROTECTION—Dockson Corp. Catalog S-55 lists complete line of head and eye protective equipment.

82. ACETYLENE GUN—Velocity-Power Tool Co. Bulletin No. 1413-3 is an illustrated description of the "Torch-o-matic" acetylene gun for brazing, pre-heating, soldering, maintenance.

83. TEMPERATURE INDICATOR—Tempil Corp. Catalog No. 541 deals with types of crayon, pellet and liquid temperature indicators.

84. ELECTRODE—C. E. Phillips & Co. 4-page pamphlet discusses the "600" electrode for producing machinable arc welds in gray iron castings, salvage repair, reclamation.

85. POSITIONERS—Pandjiris Weldment Co. Positioners—cantilever, gantry, mandrel, head and tailstock, as well as turning rolls, are the subject of illustrated brochure.

86. WELDING ROD, WIRE—The Reid-Avery Co., Inc. Welding rods and wire available for gas-shielded arc welding are described in folder.

87. INDUSTRIAL X-RAY—Holger Andreasen, Inc. Leaflet explains uses and construction of model "160 kvp" portable, lightweight X-ray unit for industrial radiography.

88. SOLDERING—Aeroprojects, Inc. 15-page illustrated Bulletin SB-5 is a discussion of "Sonobond" fluxless soldering and metal coating.

89. SPOT WELDER—Kasson Die & Motor Corp. Bulletin treats automatic spot welding through use of a "Bren-Weld" spot welder.

90. TESTING—Maintenance Engineering Corp. Illustrated Bulletin 55 gives a summary view of the repair and testing services and facilities, including emphasis upon welding repairs, of industrial machinery.

91. HARDFACING—Drawalloy Corp. 4-page folder outlines characteristics of "Wear-O-Matic" fabricated wire for automatic and semi-automatic hardfacing.

92. ELECTRODE—Alloy Rods Co. Catalog sheet gives description and application of E8016CM all-position, iron-powder, low-hydrogen electrode.

93. POSITIONER—Standard Portable Cord Co., Inc. Booklet details "Magic" positioner designed as a universal holding fixture for production and welding operations.

94. REGULATORS—Smith Welding Equipment Corp. Leaflet (Form 255) presents, in illustrated form, models of small-size regulators for welding-gas flow control.

95. BENCH WELDER—Graham Mfg. Corp. Bulletin 2000 provides illustration and descriptive resume of characteristic features and operation of multiple-gun automatic stud welder.

96. DUST COLLECTORS—Torit Mfg. Co. Catalog No. 38 features, in its 15 pages, current models of dust collectors.

97. WELDING CONTROLS—Weltronic Co. Descriptive 4-page pamphlet discusses aircraft welding controls for automatic fusion welding machine.

98. ELECTRODE HOLDER—Cam-Lok Division. Bulletin 121 depicts electrode holders with explanation of construction. Several types described.

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USE THIS CARD for Literature, Catalogs, and Bulletins shown on facing page, and for those featured in this month's ads as listed on next page

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Advertisers' Literature

153. Tweco Products Co.—Catalog on complete line of accessories and aluminum cable.

154. Unique Turn Table & Equipment Co.—Catalogue 54B describes positioners, idlers and turning rolls.

155. United Wire & Supply Corp.—"Phoson" and "Silbond" booklet on brazing.

156. Vickers Electric Div.—Information on the d-c welder.

157. Victor Equipment Co.—Manual and descriptive leaflets on coated high-alloy and other welding rods.

158. Westinghouse Electric Corp.—Data on mild-steel and stainless-steel electrodes.

159. Westinghouse Electric Corp.—Information regarding line of arc welders.

160. Worthington Corp.—New bulletin R-1700-B15 shows how to choose a positioner.

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101. Adjustable Clamp Co.—Catalog on "Jorgensen" and "Pony" clamps.

102. Airline Welding & Engr.—Complete data and samples on fusion butt welds.

103. Alloy Rods Co.—Bulletin on nickel-manganese electrodes.

104. All-State Welding Alloys Co., Inc.—Pocket reference on joining aluminum and aluminum alloys.

105. Aluminum Co. of America—Send for book, "Welding Alcoa Aluminum," on every phase of welding.

106. American Brass Co.—Information about welding rods and recommended welding procedures.

107. American Optical Co.—Catalog S-2363 on face shields.

108. American Platinum Works, Inc.—48-page booklet, "A Complete Guide to Successful Silver Brazing."

109. Ampco Metal, Inc.—Information on "Ampco-Trode" overlays.

110. Becker Bros. Carbon Co.—Catalog gives specifications, scaled drawings, etc., on carbon welder brushes.

111. Carol Cable Co.—Information on "Dynapower" welding cable.

112. Chicago Boiler Co.—Literature on welding clamps.

113. Contour Marker Corp.—Information on laying out pipe joints.

114. Dockson Corp.—Catalog on welding and cutting equipment.

115. Drawalloy Corp.—Sample of precision drawn wire for automatic and semi-automatic hardfacing.

116. Eisler Engineering Co., Inc.—Data on spot welders and general welding equipment.

117. Eutectic Welding Alloys Corp.—Case histories on welded maintenance and repair.

118. General Electric Co.—Bulletin GEC-1333 on new 200-amp, engine-drive welder.

119. Glenn Co.—Data and prices on constant-voltage welders.

120. Goldsmith Bros. Smelting & Refining Co.—Data book on low-temperature silver brazing.

121. H & M Pipe Beveling Machine Co.—Folder entitled, "More Profit Dollars In Pipe Fabrication."

122. Handy & Harman—List of "Easy-Flo" and "Sil-Fos" distributors.

123. Handy & Harman—Bulletin 20 on low-temperature silver-brazing alloys.

124. Harnischfeger Corp.—Report No. 5402 on saving money on welding operations.

125. Harrisburg Steel Corp.—Prices and literature on gas cylinders.

126. Harris Calorific Co.—Descriptive Folder No. 540710 on heating torch.

127. Hobart Bros. Co.—Information on various types of arc welders.

128. Hossfeld Mfg. Co.—Bulletin shows bender models, dies and bar, angle iron and pipe bends.

129. International Nickel Co., Inc.—Technical Bulletin T-2, "Fusion Welding of Nickel and High Nickel Alloys."

130. Kasson Die & Motor Corp.—Complete specifications on the "SP-100" spot welder.

131. Krembs & Co.—Chart and Fluxine sample available.

132. Liquid Carbonic Corp.—Details and prices on balanced-pressure regulators.

133. P. R. Mallory & Co., Inc.—Information on resistance-welding electrode designs.

134. Metal Bond Mfg. Co.—Catalog on soldering and welding products.

135. Metal & Thermit Corp.—Data on arc and thermit welding products.

136. Mid-States Welder Mfg. Co.—Welding brochure and information on automatically providing inert gas shielded arc on any machine.

137. Miller Electric Mfg. Co., Inc.—Information on various types of arc welders.

138. National Carbide Co.—Write for name and address of nearest supplier.

139. National Cylinder Gas Co.—Information on portable flame-cutting machine.

140. National Welding Equipment Co.—Book answers questions about regulators.

141. Norris-Thermador Corp.—Specifications on acetylene cylinders.

142. North American Philips Co., Inc.—Information on tungsten electrode welding.

143. Northwest Chemical Co.—Literature on the Alkalume process and line of cleaning chemicals.

144. Norton Co.—Information on B-11 resinoid bonded wheels.

145. Page Steel & Wire Div.—Folder DH-402 sets forth analyses of automatic welding wire.

146. Progressive Welder Sales Co.—Details on welding equipment built to your requirements.

147. Reid-Avery Co., Inc.—Information on Raco's "Pay-Off-Pak."

148. A. O. Smith Corp.—Catalog on mild-steel electrodes.

149. A. O. Smith Corp.—Facts and information about electrodes.

150. Smith Welding Equipment Corp.—Information on "Silver Star" cutting torch.

151. Stoody Co.—Literature on alloy tubular wires.

152. Tube Turns—Wall chart TT730 of dimensions of stainless steel welding fittings and flanges.

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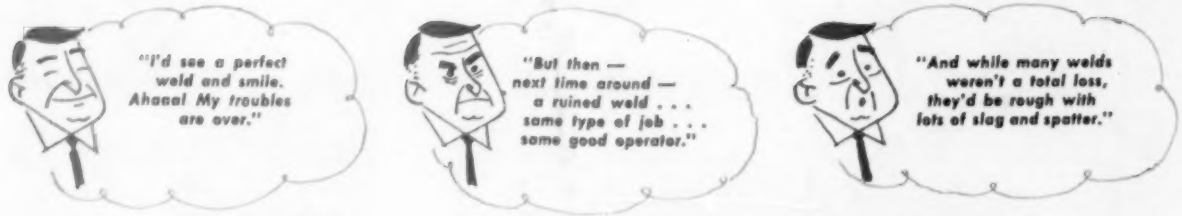
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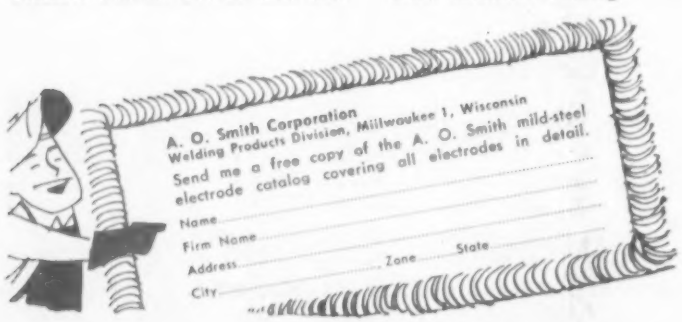

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